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ABSTRACT

This state of the art report summarizes current practice and accepted standards in library physical facility design. It is intended to serve as an interim planning guide for Army technical libraries until the completion of the Guided Inquiry System in the second phase of this study. Recommendations made in the report are based on a thorough review of the literature on library planning and design, an analysis of the present Army procedures for obtaining library facilities, interviews with librarians, building consultants and architects, and site visits to a number of different types of military and non-military libraries. The report concludes that a generic base exists from which to plan all libraries and makes specific recommendations to improve the procedures for providing Army technical libraries. Recommendations include a) using a planning team approach throughout the building project; b) using a written, fully documented building program; c) the team explore all options for a new facility; d) the team should use a proximity chart to analyze library activity relationships until the Guided Inquiry System is developed; e) the team should use the interim generic evaluation method described in this report in the evaluation process until the method is fully developed. (Author)

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TISA PROJECT REPORT NO. 33

TASK 02/014

ED 058906

② LIBRARY ENVIRONMENTAL DESIGN: PHYSICAL FACILITIES AND EQUIPMENT.

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⑤ 31 December 1971

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This state of the art report summarizes current practice and accepted standards in library physical facility design. It is intended to serve as an interim planning guide for Army technical libraries until the completion of the Guided Inquiry System in the second phase of this study. Recommendations made in the report are based on a thorough review of the literature on library planning and design, an analysis of the present Army procedures for obtaining library facilities, interviews with librarians, building consultants and architects, and site visits to a number of different types of military and non-military libraries. The report concludes that a generic base exists from which to plan all libraries and makes specific recommendations to improve the procedures for providing Army technical libraries. Recommendations include a) using a planning team approach throughout the building project; b) using a written, fully documented building program; c) the team explore all options for a new facility; d) the team should use a proximity chart to analyze library activity relationships until the Guided Inquiry System is developed; e) the team should use the interim generic evaluation method described in this report in the evaluation process until the method is fully developed in the next phase of this project.

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FOREWARD

This Phase I final report was prepared as part of a research project conducted by the School of Library Service, the Institute of Library Research, the School of Architecture and Urban Design, and the Urban Innovations Group, all part of the University of California, Los Angeles, under a contract from the Office, Chief of Engineers, Department of the Army. The project was identified as Work Unit 02/014, a part of the Technical Information Support Activities (TISA) program.

The investigators wish to express their sincere appreciation to the many individuals who aided them in the investigation. A list of libraries visited appears in Appendix 3 and a list of individuals who gave of their time and energy is given in Appendix 4. The information these people supplied was of great value to the investigating team.

A very special thank you and acknowledgement for their help is due each member of the work unit staff. Research assistants Bill Gill, David Hibbert, and Mary Moore aided the investigators in innumerable ways, especially with the literature searching and preparing graphic materials. Christie Robbins, as research assistant and bibliographer, also helped prepare this final report. The project typist Judia Campbell, and the other typists in the Institute of Library Research must be commended for their patience with the many drafts and changes they were asked to type. Mr. Robert Carmichael, the manager of the Institute of Library Research must also be thanked for supervising many of the administrative details and helping edit the final report.

On every project there is a key person without whom the project would probably not have been successfully completed. This project was no exception and the key person was Patricia Ferguson. In her capacity as project assistant, she carried out a great many seemingly thankless tasks; acted as supervisor of the research assistants, served as one of several editors for the entire final report; and throughout the project maintained her composure despite the idiosyncrasies of the investigators. Much of the credit for what ever value this report has must go to her.

Finally the principal investigator wishes to acknowledge, and make very clear, that this report was a team effort of architects and librarians. In a sense the report is reflective of the way in which the investigators approached the project. Each had a responsibility to initially prepare a major section; however, in this final report, all sections have contributions from all the investigators. He also wishes to express his thanks to the co-principal investigators and consultant for their cooperation in the task of preparing the final report.

G. Edward Evans - principal investigator
Ralph Iredale - co-principal investigator
Peter Kamnitzer - co-principal investigator
Thomas Vreeland - co-principal investigator
LeMoyne Anderson - consultant

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ABBREVIATIONS USED IN THE DATA TABLES

Lf	linear foot
sf	square foot
cf	cubic foot
asf	assignable square feet
max	maximum
min	minimum
pop	population
rec	records
hs	high school

INTRODUCTION

This state of the art report has been prepared as Phase I of a project contracted by the Department of the Army, Office, Chief of Engineers, Technical Information Support Activities (TISA) program. The series of TISA projects is concerned with research and development to provide more effective support for technical libraries, information centers and information analysis centers within the Army.* The focus of this project, TISA Work Unit 02/014, has been on the provision of the physical facility and its furniture and equipment.

Objectives

The first phase (1 October 1970 - 31 December 1971) has produced an evaluative state of the art report documenting current practice in the design of Army technical and other library physical facilities. Included in the report are indications of valid practice, areas in need of research, and recommendations for interim use pending completion of the entire study.

Phase II will undertake some of the major research identified during the first phase. The ultimate goal is seen as a comprehensive guide for the Army librarian faced with planning new quarters, renovating an existing building, adapting to an assigned space or programming an entire library facility. Research results, combined with current valid practices, would form the basis of a Guided Inquiry System, a flexible, integrated program designed to lead the user through the complexities of library planning.

Organization and Methodology

Phase I was a joint effort of librarians and architects associated with the Institute of Library Research, the School of Architecture and Urban Planning, and the Urban Innovations Group, all at UCLA. Dr. G. Edward Evans, of the School of Library Service, was Principal Investigator, Professors Ralph Iredale, Peter Kamnitzer and Thomas Vreeland of the School of Architecture and Urban Planning were Co-Principal Investigators. Dr. LeMoyne Anderson, Library Director at Colorado State University, was a Consultant.

An Advisory Panel was appointed by the contracting agency as a means of quality control. The functions of this panel included reviewing the tasks, suggesting areas of inquiry and reviewing the overall direction of the study. The panelists met with the project staff and contract monitors on three occasions, following receipt of the three quarterly reports, and approved the research methodology. In addition, they were contacted by mail for their reactions to the scope of the literature search and their recommendations for library site visits and personal interviews. The following is a list of the Advisory Panel members:

---

*The relationship of information centers and information analysis centers to TISA is explained in the Exploratory development plan for TISA, January 1969.

Librarians

Ralph Ellsworth
Keyes Metcalf

Architects

John Eberhard
William Caudill

Federal Library Committee,
Task Force on Physical Facilities

Michael Costello
Karel Yasko

Seven major task areas were identified and carried out, the last task being the production of the state of the art report covering current library design:

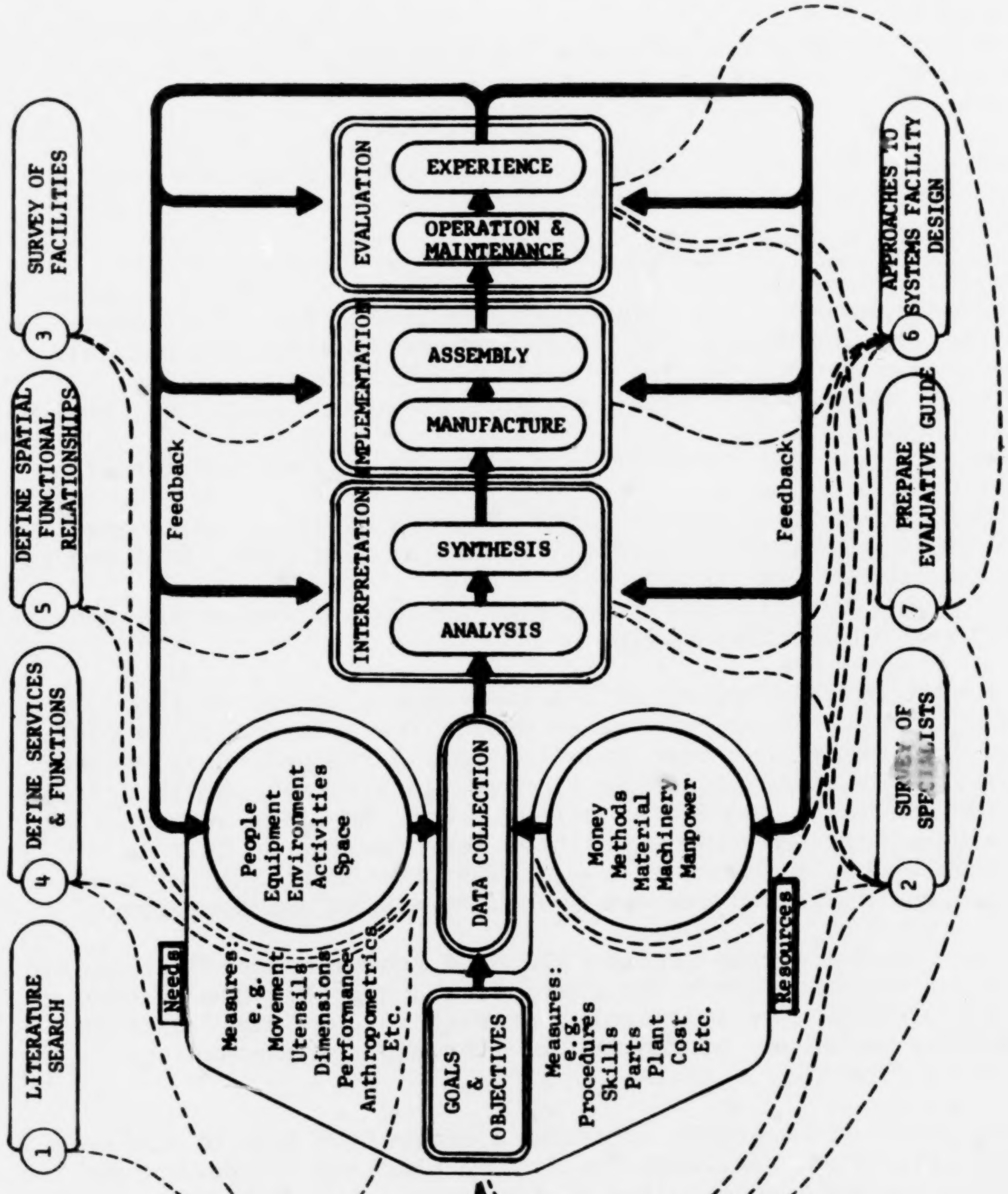
1) Inventory present design standards
2) Survey selected library specialists
3) Survey existing library facilities
4) Define types of library services and functions
5) Examine approaches to library functional requirements criteria
6) Explore approaches to systematized facilities design
7) Prepare final report

A decision-making systems schemata was superimposed on these tasks to ensure adequate identification with the actual library planning process. The systems approach encompassed:

Goals
Data Collection
Interpretation
Implementation
Evaluation

The diagram on page 13 presents the study methodology in graphic form.

MODEL OF TISA WORK UNIT 02/014


1 LITERATURE SEARCH
4 DEFINE SERVICES & FUNCTIONS
5 DEFINE SPATIAL FUNCTIONAL RELATIONSHIPS
3 SURVEY OF FACILITIES
2 SURVEY OF SPECIALISTS
7 PREPARE EVALUATIVE GUIDE
6 APPROACHES TO SYSTEMS FACILITY DESIGN
Feedback
Feedback
Needs
Resources
People
Equipment
Environment
Activities
Space
Money
Methods
Material
Machinery
Manpower
DATA COLLECTION
GOALS & OBJECTIVES
Measures: e.g. Movement Utensils Dimensions Performance Anthropometrics Etc.
Measures: e.g. Procedures Skills Parts Plant Cost Etc.
INTERPRETATION
ANALYSIS
SYNTHESIS
IMPLEMENTATION
MANUFACTURE
ASSEMBLY
EVALUATION
OPERATION & MAINTENANCE
EXPERIENCE

Report Format

This evaluative state of the art report on library physical facilities is divided into four sections:

Section A: Physical Facilities for Army Technical Libraries
Section B: Physical Facilities for Libraries in General
Section C: Implications for Future Library Planning and Design
Section D: Conclusions and Recommendations

In Sections A and B the five systems elements described earlier have been chosen as natural sub-divisions of the material presented.
Data Collection (V) appears last in each section due to its purpose. It is intended to be a compilation of current opinion on standards, materials, furniture, equipment and requirements for library facilities. Here are brought together the regulations and recommendations presently available for interim use.
Goals (I) defines the purposes and functions of libraries, present and future.
Interpretation (II) documents the planning process and resulting facilities.
Implementation (III) examines the entire network of steps involved in obtaining facilities for Army technical libraries, followed by recommendations for improved procedures.
Evaluation (IV) discusses the cyclic process of evaluation and its importance in facility design.

The format of this report will allow readers to choose the particular section and part most useful to their immediate concerns. An effort has been made to address the principal persons usually involved in procuring library facilities: the librarian, the administrator and the architect. Each may find portions of the report very familiar and others less familiar. This is inevitable when a document is addressed to three distinct groups of readers, each with its own special training and background.

Section C outlines the generic planning system proposed as one of the major research areas for Phase II and suggests new procedures for the provision of technical libraries in the Army. Section D contains a summary of the conclusions and recommendations resulting from this study.

The Selected Bibliography contains a classified list of the more useful literature available on library planning and design and includes the references cited in the text. This selection was made from a comprehensive search of the literature produced during 1960-1971, including print-outs of pertinent literature in the ERIC and DDC systems. The taxonomy chosen to organize the material precedes the bibliography and is related, as closely as possible, to the various parts of the report. Inclusion of material does not necessarily constitute a recommendation that it be read, since an effort has been made to include some references on each of the major areas searched.

Synopsis of the Report

As a result of the literature survey and extended discussions with a number of librarians from all types of libraries, we feel there is a broad common base to librarianship and information science. In particular the commonality is reflected in the physical facility. Is there a real difference between the reading areas in a public, academic or special library? Each contains reader stations, some individual and some group seating, and study spaces. Each type of library has lounge furniture, tables and chairs, and study carrels. The distinction lies in the number of seats and in the proportion of seating types - a matter of emphasis, not of kind. Without examining the collection can one really tell the difference between reference areas in different types of libraries, or whether the circulation desk (minus signs) belongs in a special or a public library? Equally difficult to distinguish, on the basis of physical characteristics alone, is a Federal library from a non-Federal, military or Army technical library. The point is to emphasize the similarities in the basic spaces and equipment. However, it is neither possible nor desirable to propose a 'package library', for each library does have special features and emphases that in some way distinguish it from other libraries. It is equally true that no library is completely unique.

In this report we are suggesting there is a set of generic aspects involved in all library physical planning, and we conclude that most of the differences are due to emphasis. Consequently, we felt it desirable to include a discussion of all types of libraries in a report aimed essentially at Army technical libraries.

The survey of literature, the visits to facilities* and interviews with many librarians and other specialists**, confirmed that very little hard data exists that is exclusive to Army technical libraries. There is a need, therefore, to make an appropriate selection of relevant data, and to institute procedures to ensure their constant updating and relevance. This can be achieved by studying the requirements and recommendations for other types of libraries, as it is evident that there are similar requirements for all libraries. The data should be related to a generic structuring of library functions and activities, which requires needs be fully identified and articulated.

In this brief section we summarize our major conclusions, list our recommendations, and outline the major research areas for Phase II.

---

* A list of the libraries visited is contained in Appendix 3.

** An alphabetical list of persons interviewed is contained in Appendix 4.

Conclusions

1. There is a generic base from which to plan and design all types of libraries.

2. There has been and will be very little basic change in the role and function of libraries, only changes in emphasis.

3. There has been little change in the process of planning and designing libraries during the last ten years.

4. There are no procedures developed specifically to meet the needs of Army technical libraries.

5. There are published definitions of functions, purposes and roles of Army technical libraries, but they are not adequate as a basis for developing a sound written building program.

6. There is a need to employ a multi-disciplinary team to plan a new physical facility, especially for Army technical libraries, where the design process is very complex due to existing planning constraints.

7. There is a need to have a detailed written building program, especially for Army technical library facilities, due to the long duration of the present building cycle, changing personnel, and potential changes in mission goals.

8. There is a need to develop techniques which allow for the evaluation of a great many design options, especially when designing a facility to use an existing space.

9. There is a need to develop a system that will allow the generation of design criteria from an analysis of activities rather than from arbitrary existing standards.

10. There is a need to develop procedures for coordinated decision making throughout the entire building cycle, rather than isolated decision making.

11. There must be a better understanding of the implications of administrative, professional, capital, operating and maintenance costs on building life costs.

12. There is a need to simplify and shorten implementation procedures to achieve a faster design and construction time and reduce the overall cost of the project.

13. There are no operative, objective procedures available at present by which one may evaluate a library facility.

14. There should be a thorough review of all alternative facilities available which could provide the required amount of space, to ensure the likelihood of making the best decision about a new facility.

15. There is a need to make the evaluation process an integrated element throughout the entire planning and building cycle.

16. There is a great need to make post-construction evaluations of new facilities in terms of what the planners had expected and hoped to achieve in their original designs.

17. There are so many varied sources of information on specific space allocations and environmental performances, that it is very difficult for the planning team to evaluate the authority with which the recommendations are made.

18. There is a great range of apparently specific recommendations and quantification, but there is no assurance that the data are valid or useful.

19. There is little evidence that specific recommendations for space, light, seating, and other factors are based upon carefully controlled and unbiased testing programs.

20. There is, therefore, a need to examine all such data and, when necessary, set-up procedures to determine their validity.

Recommendations for Interim Use

All of the following recommendations are directed specifically to Army technical libraries; however, most of them can also be applied to the planning of any type of library.

1. The project librarian should be appointed at the inception of the project.

2. The project librarian must clarify the local library mission goals in the context of broader (military) institutional goals prior to preparing a written program.

3. The project librarian should identify the total user population and all major parameters, such as cost and time targets.

4. The project should be handled on a team basis with all members of the team involved throughout the entire project.

5. The planning team should include representatives of the user community to ensure a balanced planning base.

6. The team should explore all the alternative options for a new facility before moving ahead with the planning.

7. The team must make every effort possible to ensure adequate communication using mutually defined terms.

8. The team must prepare a detailed written program to provide a justification for the project and to clarify the understandings reached by the team members as to the requirements of the project.

9. The written program should be used as the means of communicating project requirements to individuals who are not team members.

10. The team should use a proximity chart for analyzing activity relationships until such time as the Guided Inquiry System has been developed in Phase II.

11. The team should review a large number of alternative design solutions in order to find the best possible solution, given the existing constraints.

12. The planning team should use a checklist of the elements of worth to institute an evaluation process.

13. The planning team should set the evaluation process using the generic evaluation methods described on pages 116-118.

14. The design data listed below are recommended only in the sense they are relevant to the design of Army technical libraries and some data must be used. All of the comments about the design data in Section B.V apply to these data. They can be used until such time as a set of tested specifications can be developed.

    a. allocate .1 sq. ft. per volume of the existing collection

    b. allocate 25 sq. ft. per reader station

    c. allocate space for 10-15% of the user community

    d. allocate 150 sq. ft. per library work station

    e. allocate .1 sq. ft. per 4 reels of microfilm

    f. allocate .1 sq. ft. per 9 maps

    g. allocate .1 sq. ft. per 6 phonograph records

h. use the AASL recommendations for non-book materials (see pages 138-9).

i. ceiling height can be as low as 8'6"

j. use the Wheeler-Githens formula (page 134) as a check for total space allocation

k. try to keep the non-assignable space to less than 20%

Recommendations for Further Research

Research and development is urgently required on a number of interrelated subjects, although each could be undertaken as a separate study if this were the only practical alternative. A means of coordinating their related aspects must be found, however, if the work and results are to be fully effective. Among the topics identified are the following:

1. A study of user behavior patterns in existing libraries to establish correlation between use and environmental factors, with regard to the various functions identified in this study, and for different types of libraries.

2. An evaluation of the psychological impact of the total building environment on its users, including factors related to its location, access, etc.

3. Development of criteria to establish relevant measures of the effectiveness of the library services being offered once the facility is in operation, in regard to types of users, individual functions, type of library, etc.

4. A study of possible alternative administrative procedures and organizational arrangement (both existing and as potential for the future) in respect to procurement methods so as to develop and test selected options under real world conditions.

5. A comprehensive study of project management and control procedures, making recommendations for the selection and application of those with the greatest potential for effecting improvement in current procedures.

6. Development of a comprehensive hierarchy of all potential library activities within the functional relationships defined in this study.

7. Development of appropriate ranges of environmental performance criteria and measures for Army technical library facilities.

8. Development of methods for generating alternative environmental design solutions.

9. Development of effective evaluation procedures for use at various stages in the design, construct and operate cycle.

10. Identification and definition of a prototype library construction project as a vehicle for implementing some or all of the above research and development program.

SECTION A

STATE OF THE ART:

PHYSICAL FACILITIES FOR ARMY TECHNICAL LIBRARIES

INTRODUCTION A

Within the Army there are two categories of libraries. Technical, academic, and special libraries are included in the first category. Post and camp libraries, sometimes referred to as base libraries, make up the second category. Libraries in both of these categories experience pressures to expand the size of the collection and the staff as more and more demands are placed upon library resources and personnel. When an existing facility cannot meet these demands, it becomes necessary to expand the facility or curtail services. The usual solution requires obtaining additional space, either by adding to the existing facility, by securing additional space in another location, or by moving to a completely new facility. Each alternative presents special problems; all require careful detailed planning of the space(s) available and involve the application of complex approval and funding procedures.

The planning problems for an Army technical library are similar in principal to those entailed in planning any other type of library facility, but the system of procurement is usually not as clearly defined as for post and camp libraries. This arises not only because many more libraries of the second category are constructed, but because they are constructed as part of the larger barracks complex, the provision of which is elaborately documented and structured. With very few exceptions, libraries in both categories have failed to secure adequate functional facilities. Most of the issues which contribute to this situation are far beyond the immediate scope of this report for they include:

1. National and Regional command priorities
2. Local base priorities
3. Financial resources available
4. Local information needs and resources for satisfying those needs
5. Attitudes about libraries of individuals involved in the planning process
6. Organization of planning group
7. Documentation and support for new facilities
8. Regulations governing space allocations
9. Approval procedures

This report is concerned primarly with the last four factors (Numbers 6-9), but contains some observations about potential improvements to the other issues. While this report cannot presume to solve the problem of priorities, it is intended to provide information to help project planning groups present solidly justified requests and thus move libraries up in the list of priorities.

In the past, under the existing system, very few new library facilities have been approved. In fact, libraries are usually allocated a space within an existing or proposed structure and a new building is rarely contemplated. In the last five years, no new technical libraries have been developed within the Army, while several new post and camp facilities have been constructed, some using non-appropriated funds. No doubt much of the difficulty lies in the marked reduction in funds available and in the low priority generally assigned to libraries in requests for funds. We do not suggest the basic situation will be changed by this report. However, the report should help the planning groups produce more substantiated requests, and, if and when approval is granted, improve the chances of producing a satisfactory library. Part of the problem also lies in the availability of authoritative documentation; this report will supply backup documentation and references, where appropriate, in addition to strictly Army resources, to support requests for facilities. Finally, several changes in the process of design and implementation are proposed in this report. These are designed to maximize the benefits to be derived from a clearer and more fully justified substantiation of needs, and to reduce the overall period of implementation. Faster completion times should provide greater satisfaction to library users and costs can be more nearly related to estimates.

The environment will continue to change. For example, VOLAR - voluntary Army - when it becomes fully implemented, will probably create new sets of requirements, especially for post and camp library facilities, and the library will probably receive a higher priority. Technical libraries, which should always have a high priority, also may benefit from the change. That is, when library service on a base increases in scope, visibility and quality, more people will become library conscious; consequently, the demand for its service should make the matter of securing local approval and support less difficult. The primary problem is largely one of convincing decision-makers of the need and worth of libraries and information centers. Worth is established on the basis of experience and observation. A library which has provided excellent service to base personnel, either work related or with recreational materials, is more likely to gain local approval and receive requests for an extension in its service.

In the following pages we discuss Army technical libraries and to some extent post and camp libraries. Goals and objectives are related to physical facilities; the system currently used to design Army libraries is described along with the problems of evaluating results; and a major section is concerned with the process by which Army libraries are built. A final section covers Army regulations relating to space allocation.

GOALS A.I

WHAT IS THE ROLE OF AN ARMY TECHNICAL LIBRARY?

The purpose of this report is to explore only those aspects of Army technical libraries which affect the provision of facilities, and to define their role in that respect. Since this report also may be used by civilian architects, brief descriptions of the broader role and function of the technical library have been included. These descriptions are based upon other reports generated in the TISA program and are, therefore, considered to be the most authoritative sources. Several of the studies funded by the Corps of Engineers TISA program define the library's role in what appear to be very generic terms, and seldom address themselves exclusively to Army technical libraries. Usually they purport to discuss federal libraries, but they generally extend to all types of libraries, including those existing outside the federal government. On the basis of TISA Reports 23 and 29, the service role and scope of Army technical libraries may be described as follows:

> "The federal library has a tradition of dealing primarily with books or book-type material. Its functions related to those materials involve the acquisition, collection, recording, organization, storage, retrieval and to a certain extent dissemination of materials. The library is for the most part discipline oriented, but is inclined to be staffed by the professional, funded as an overhead item, and placed in a relatively low subordinate position in the organizational structure of the agency.
>
> The federal information center has been characterized as dealing with information, data, or the contents of books. Its functions seem almost identical with those of the library: acquisition, collection, recording, organization, storage, retrieval and dissemination of this data or information. They are, however, usually extended to include some others oriented toward service particularly: compilation, creation and publication of information itself. The information center is apt to be mission oriented and hence supports the activities of a narrow and limited clientele. It is staffed by subject specialists with research background, funded as a special item in support of a particular program, and maintains relatively the same organizational position as the library. . .

> Thus while the lines and the differentiation between the role of the library and other information activities may seem definite to some at present and less definite to others, the library cannot legitimately, especially in the federal complex, be consigned to play merely the storehouse. Indications are that the libraries are moving toward the information centers and the information centers are moving toward the libraries in all aspects. The distinctions are being worked out: personnel of both professional and subject expertise is coming into both, funds are being supplied on all levels, services are melding, users demands and their satisfaction center around not just materials but also information. The lines of demarcation are now disappearing and should continue to disappear. The whole concept of the library and the information center is changing and the answer seems to appear in systems or networks (made up of many parts whether labeled libraries, information centers, data analysis centers or clearinghouses). No one is yet quite sure of the character of the system of network." (1)

TISA Report 29 also describes the role and function of Federal libraries:

> "The Federal Library Mission
>
> Definition and Scope
>
> Federal libraries support the missions and programs of their agencies principally by providing bibliographically related information services. To achieve this objective they have at least four basic responsibilities.
>
> a. To collect and organize pertinent recorded information, in whatever form required, to meet managerial, research, educational, informational, and other program responsibilities;
>
> b. To provide ready access to their materials and to assist users in locating required information;

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(1) Painter, Ann F. The role of the library in relation to other information activities. TISA Report No. 23. Indiana University, Graduate Library School, Bloomington, 1968, p. 49 and 51.

> c. To disseminate pertinent information from their collections on a selective basis;
>
> d. To make their collections and service known to present and potential users.
>
> Library Functions
>
> To discharge these basic responsibilities, Federal libraries perform a range of tasks including assistance to users through literature searching, reference service, bibliographic work, professional guidance to readers, lending and borrowing materials, and by supporting these services through selecting, acquiring, cataloging, indexing, and abstracting pertinent materials. The effective performance of these functions requires continuing appraisal of the information needs of the agency." (2)

By substituting "Army technical library" for the phrase "library" or "Federal library" one has a very general definition of its role and function. In determining the building program it is the librarian's responsibility to spell out the specific mission and function of the library, as these factors may influence the design of the physical facility.

The distinction between a library and an information analysis center, information center, data analysis center, etc., is made in ATLIS Report No. 2:

> "An information analysis center is an organization exclusively concerned with review or analysis of scientific or engineering data. It is distinguished from a documentation center or a library whose functions are concerned primarily with handling documents rather than the technical information in the documents. Technical information center is defined as an organization concerned with receiving, processing and distributing technical information to internal and external users. A center's functions may include, but are not necessarily limited to, reports preparation services, primary production and distribution, technical editing, graphic arts, still and motion photography, and to technical library and information analysis

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(2) The Federal Library Committee. The Federal library mission: a statement of principles and guidelines. In: Conaway, O. B., Extra-library information programs in selected Federal agencies. TISA Report No. 29. National Academy of Public Administration, Washington, D. C., 1970, p. 12.

> center activities. Technical library is considered a service activity that selects, acquires and organizes documents for retrieval to support the scientific and technical efforts of the parent organization. Services may include but are not limited to preparing and publishing accession lists, indexes, abstracts, and bibliographies." (3)

Of interest is the rather open ended nature of the definitions; none of them is so narrow as to eliminate from consideration all but Army technical libraries. Certainly in the last definition, aside from the phrase "scientific and technical", nothing differentiates an Army technical library from any other library regardless of service population or organizational affiliation. Use of the words scientific and technical defines the basic content and orientation of materials and may in some cases have an impact upon the physical facilities. As a very broad generalization, technical libraries tend not to be archival in nature and they may increase in size more slowly than libraries with an archival purpose. This may influence the physical facility size. Beyond that point there are a great many individual variables, as is implied in the definition "include but not limited to". All this emphasizes the need to develop a thorough building program. It also emphasizes the generic nature of libraries and, in terms of facilities, indicates there is little difference in kind but rather in terms of emphasis.

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(3) User's guide to technical library services. ATLIS Report No. 2. Department of the Army, Washington, D. C., April 1967, p. 4.

INTERPRETATION A.II

HOW HAVE ARMY TECHNICAL LIBRARIES BEEN DESIGNED?

To say there is a recognized design process for most Army technical libraries is to overstate the situation to a very high degree. In general, Army technical libraries are simply allocated an area within a building. Seldom is there an adequate number of square feet. Less often is the area comprised of open space that is completely flexible. Often it is composed of space here and a room there until the authorized number of square feet are secured. Under any of these conditions, even a leading authority on library operations and facilities would find it impossible to set up an efficient operation required to provide proper service. Because of the restraints imposed by the physical facilities, the best that skilled and experienced space planners could hope to do would be to minimize inefficiency. Very few librarians have the opportunity to be involved in planning one new library facility, much less the opportunity to develop even a minimal skill in space planning based upon experience with a number of projects. These factors mitigate against good or even effective design. The planning process for Army technical libraries, such as it is, seldom employs a planning team. Not infrequently the facility is planned at the local level by the librarian and the base engineer. Decisions which relate to functional aspects can be taken independently by administrators. This level of independent decision making by people with limited comprehension of the problem frequently results in inadequate facilities. The design process should be an inter-dependent process, requiring close collaboration at all stages between librarian, designer and administrator. Until more satisfactory procedures can be developed, such as the Guided Inquiry System proposed for Phase II, it is essential to introduce into the team someone with broader experience in the area of library facility planning and design.

A poorly designed facility is detrimental to the entire concept of information-library service. The work flow can be ineffective; people may have to expend more energy than they should to accomplish their purpose; materials may be damaged because of poor storage provision; and because of confusing storage arrangements, dictated by the physical circumstances, some materials may be virtually lost to the unaided user. The physical facility affects, to a greater or lesser extent, all aspects of service. In essence, even if the most knowledgeable staff is secured, capable of providing all the desired services, and all the required documents are available, there would still be a significant loss in performance, time, energy, and money if the physical facility is not adequate. Inadequate, poorly planned facilities, whether in a one-room operation or a multi-story building, are costly and in the long run, uneconomic no matter what the capital costs may be. Operating costs are constantly escalating; a "small inconvenience" created by the design can generate many problems in the day to day operation, some of which cannot be easily measured in dollars and cents.

Analysis of Activities

The basic problem is the lack of an adequate programming process. It is our considered opinion that the planning process ought to begin from the "inside out", rather than from "outside in"; "form should follow function", to quote the internationally famous architect L. H. Sullivan. One should begin with the activities that take place and examine their needs for space, equipment, furniture and environmental factors. When the solutions for the "inside" have been completed, one can begin the design of the overall facility ("the outside") which in turn can be related to its wider site setting.

Army library practice, as is the case in most other Federal library facilities, seems to be related primarily to fund allocation procedures. This assumes that the overall space area requirements can be established by some means, in a priority manner, and that the activities can be forced into the space at a later date. More often than not the basis of square footage requirements seems to be arbitrarily determined, and to bear little relation to specific needs and to the relationships of the various functions. A number of examples of Army military and Federal library facilities fall into this type. Most of these are libraries within existing buildings, where the librarians had to fit activities into a predetermined space of a specific configuration. The configurations, such as at Picatinny Arsenal, the Department of Housing and Urban Development, and the Department of the Army, Office of the Chief of Engineers, involve restraints which were almost impossible to overcome, even for the most experienced planning teams.

To demonstrate some of the problems imposed by predetermined space factors, we have chosen to illustrate and discuss several of the libraries visited during this project. The plans of the three libraries noted above show some of the problems imposed by having the external configuration determined first and then having to fit the required library service into the area.* We also comment upon some of the problems resulting from predetermined space allowances that fail to recognize all the library requirements, for "Standard plans" predetermine both external configuration and internal space allotments. The libraries illustrated were chosen because they represent a range of problems and are rather typical of technical/special libraries. They were also chosen because the investigators visited them and toured the facilities. In addition, adequate building plans were available for use as illustrations. They were not chosen because they represent any extreme, good or bad, in design. They do illustrate many of the compromises the librarian and planning group must make when they work within an existing area in a larger building complex.

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* These plans appear on pages 34, 36 and 32.

Library, Office, Chief of Engineers

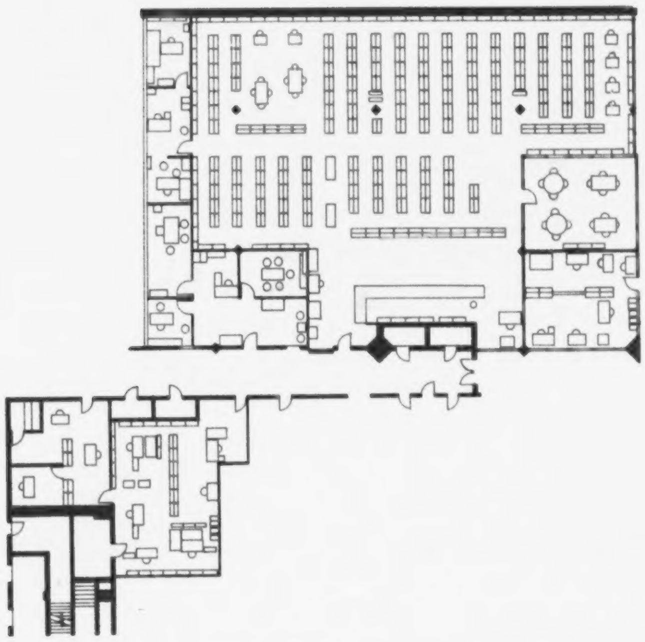
This is an example of an Army technical library located within a building (Forrestal Building). Located on a below-grade floor, the facility consists of 8,696 square feet divided into two areas by a hallway. As usually happens with below-grade locations there are no windows, creating certain psychological problems. There is a total reliance on artifical light, which in this case is not completely satisfactory. While the matter of lighting levels and what level creates an eye straining situation is open to debate, one investigator on this project spent many days working in the library and found the lighting to be a considerable strain. He could not tolerate more than a four hour exposure. Although this is only one experience it is likely to be repeated a number of times by a number of different users. There are also implications for library staff members who must work in this environment all day, particularly as other spaces within the same building with daylight and exterior views have a much more pleasant atmosphere. The problem is further aggravated by the requirement to use standard government furniture. Whenever a facility is located below grade more effort needs to be expended to make the environment as pleasant as possible, expecially when there will be extended periods of reading or other eye straining activities.

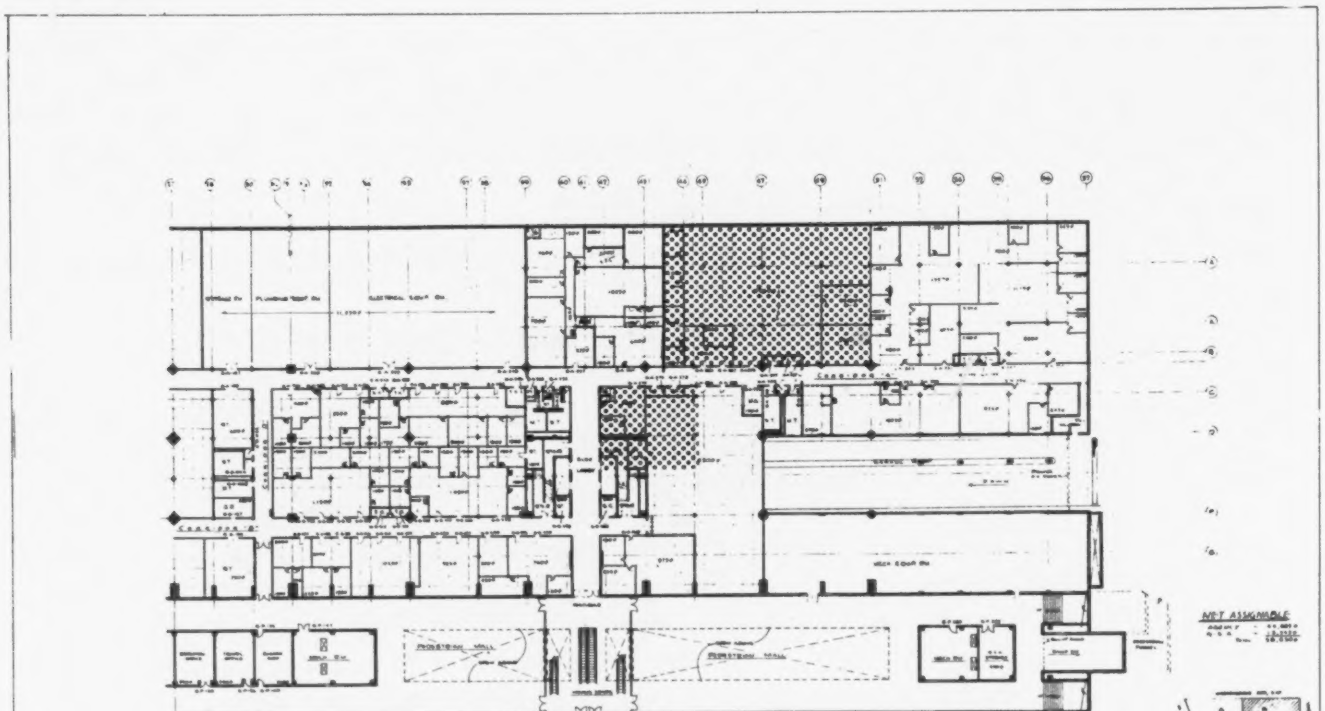
The location also makes the library remote from the community of users it is intended to serve. One of the basic tenets of library planning is to locate the facility either in the center of the activities or across a major traffic pattern of the community of users. Although a formal use study was not conducted, the investigator who worked in the facility over a number of weeks noted that at no time were there more than six users in the library. Since this was not a formal study no conclusions may be drawn from the observations. However, both the eye strain experience and the apparent low use rate indicate two areas in which more precise data needs to be collected for a number of Army technical libraries. This work should be conducted during Phase II, in order to establish better criteria for the planning process.

The other major problem is the division of the facility into two physical units. An ideal work flow and the most efficient use of

OFFICE, CHIEF OF ENGINEERS, LIBRARY

FLOOR PLANS scale 1" = 50'




NET ASSIGNABLE
KEY PLAN
G.S.A. REGION 3 P.B.S.
AGENCY:
DEPARTMENT OF DEFENSE
JAMES FORRESTAL BUILDING
GROUND FLOOR PLAN - PART B
REVISED

the square footage is not always possible when the facility is physically divided. The work space in the smaller area (technical services) had to fit into a space defined by the fixed walls of the corridor, stairwell and utility rooms.

Unfortunately the situation reflected in this example is rather typical of what Army technical librarians face in their physical facilities. Specifics may vary but the general picture is much the same.

Picatinny Arsenal Library

This example shows another aspect of the planning problem. The technical library is almost always given space in which the overall configuration has been determined. All the planning team is able to do is try to make the best of a situation which is usually awkward and, on occasion, almost impossible from the viewpoint of efficient library operation. In this case the problem has been further aggravated by the need to share the space with another operation. The space problem is also complicated by the library being assigned a storage facility (5,000 sq.ft.) one quarter of a mile away from the main library.

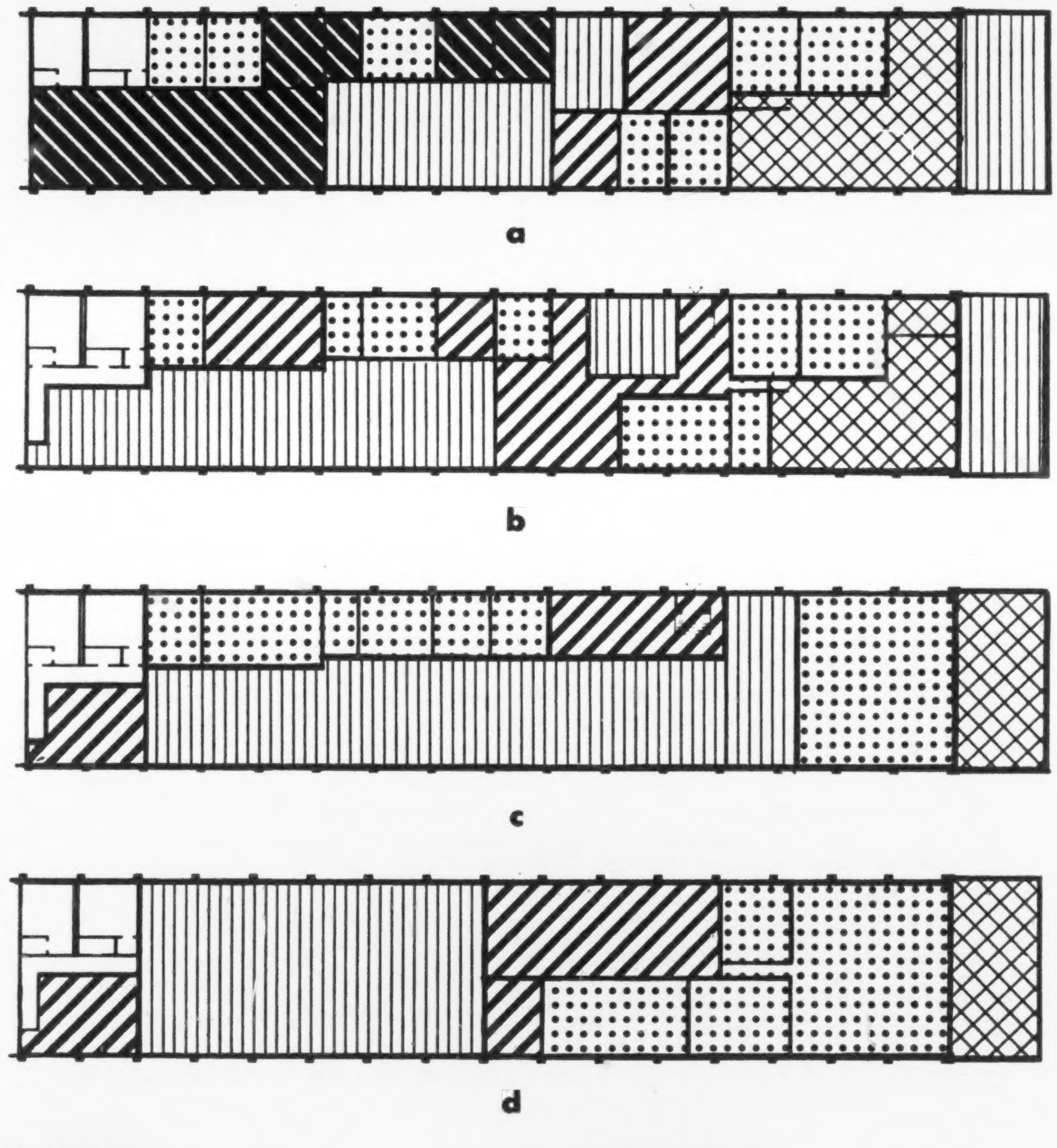
At Picatinny the configuration is linear as the building is one reminiscent of the one-story masonry barracks with steep pitched roof found on many Army posts. As can be seen in the plan, the long narrow configuration creates a linear facility. Both staff and users must walk considerable distances. The open stack area is long and narrow, forcing people to move about more than might be desirable.

On page 34 the existing facility is shown in (a); (b) represents a plan submitted for adding to the square footage of the present library, when the other user vacates the space; (c) and (d) illustrate two alternative design solutions, (c) using most of the existing rooms and (d) involving a complete remodelling. Because there is a proposed change in the facility it seems appropriate to use this library plan as a model for illustrating how alternative design solutions for a predetermined space may vary. A great many factors enter into the selection of a solution, and for this reason no judgment is made as to the desirablity of any of the solutions.

One aspect of the existing library (in addition to its linear nature) stands out clearly. Because the Programming and Planning Division also occupies the facility, there is a mixed use of the space by both operations. While it may not be a critical problem, it cannot make the operation any more efficient.

PICATINNY ARSENAL, LIBRARY

FLOOR PLANS scale 1" = 50'


a
b
c
d
other service organization
staff
stacks
readers
classified storage

In (b) the space becomes completely library occupied. The proposed plan adds and removes some interior walls and closes an existing external door. The result is an increased emphasis on the linear aspect of the facility. Staff members are located throughout its entire length, as are the materials. The readers are concentrated near the entrance. Unclassified reports are located behind the classified material; this could create a security or staffing problem.

Accepting the walls as given in the proposed facility (b) and adding two additional walls and removing one, an alternative design is shown in (c). This alternative concentrates users, open access materials, and staff, except those working in the classified area, and at the same time reduces the mixing of staff and reader stations found in (b). It also provides better control of the classified area.

A complete renovation is shown in solution (d). It provides maximum flexibility in stack and reader areas. The arrangement would allow either mixed stack-reader areas or separation as shown. All the staff is concentrated near the entrance and reader areas. The concentration of staff minimizes staff circulation in the work area, and also places them near all but one of the service points. This alternative keeps the building limitations to a minimum.

The Department of Housing and Urban Development (HUD) Library

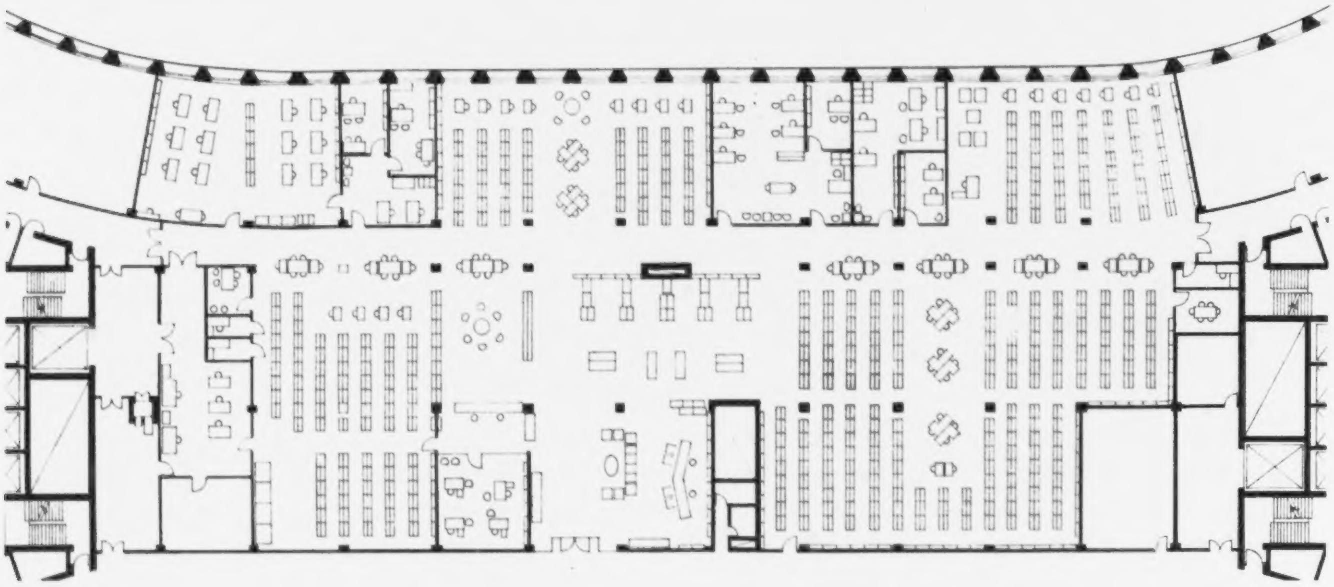
The HUD Library illustrates the similarity in the problems of designing library facilities whether they are military or civilan. Located in a new building, it illustrates many similar problems to those encountered in the Office, Chief of Engineers library. Both libraries are about the same age.

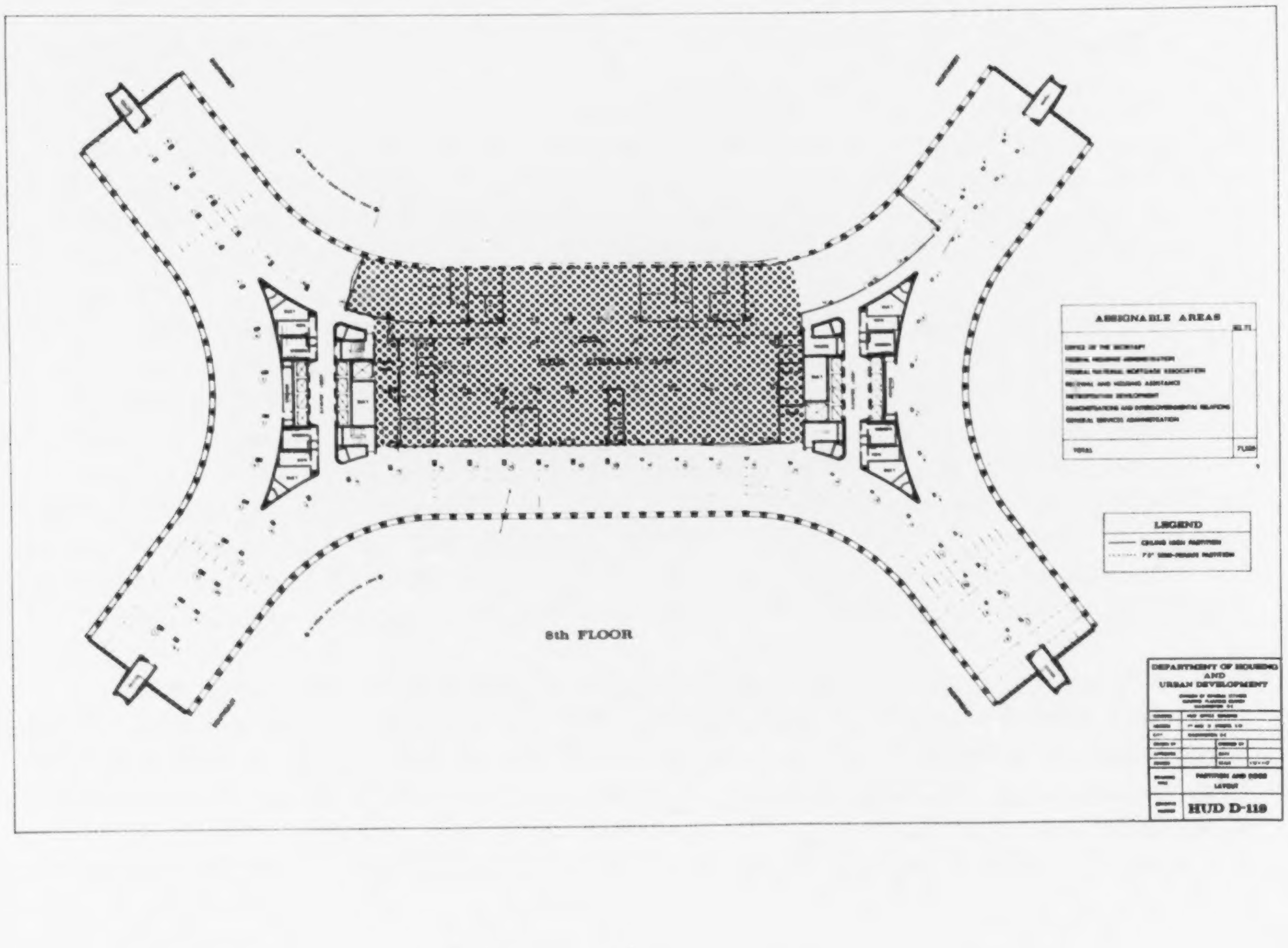
The exterior wall of the building is curved and, because of the size of the floor, there are two main hallways on each floor. Because of its square footage requirements, the library was located across one of the main hallways. As a result the library is constrained on two sides by the exterior wall and a main hallway, and on the other two sides by the vertical circulation stacks. As with the Chief of Engineers library, problems arose by having a corridor divide the library as well as by having some utility areas and duct work impinge upon library work areas.

By obtaining special permission to absorb the hallway which divided the library space, more effective use of the total space was made possible. This was a feasible proposition because of the existence of the second corridor. Because of fire regulations the library has three exit control points. (Librarians are frequently confronted with the people/material/security/control

HOUSING & URBAN DEVELOPMENT LIBRARY

FLOOR PLANS scale 1" = 50'




ASSIGNABLE AREAS
TOTAL
LEGEND
8th FLOOR
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
HUD D-119

dilemma). In this situation, deciding to absorb the hallway in favor of achieving more flexible use of the rest of the space was the trade-off the planning group chose to make in place of having a single exit control point.

For a number of reasons one of the investigators who has used the facility occasionally feels it is an excellent work environment. In comparing it to the below-grade situation encountered in the Chief of Engineers facility, one must remember the HUD Library has the advantage of an exterior wall and upper-story location with ample fenestration. Nevertheless a better quality of lighting (based on subjective evaluation), the extensive use of non GSA furniture, color, and the use of carpeting, creates a very pleasant working atmosphere for users and staff. (There is some question about the use of GSA equipment. The ASPR 5-102.3, 30 April 1971, Rev. 9, indicates "no exceptions" for most library equipment but not everything is covered and the librarian should check this very carefully. See section B.V. for a further discussion of GSA furniture and equipment.) Overall it gives the feeling of a carefully and thoughtfully designed environment, rather than a mere assemblage of library furniture and equipment.

Post and Camp Libraries

Another type of problem, illustrated very clearly in post and camp libraries, is the predetermined space allocation based, in large measure, upon an inaccurate evaluation of the user population. The space allocation is based upon troop strength, rather than the total user population which includes dependents and civilian staff. Along with this problem is the presence of standard plans based upon these space allocations. If the local post or camp librarian is not careful, the standard plan with the basic interior design, may be built even if there are additional considerations. The existence of standard plans may even exclude the librarian from participating in the planning process.

Two new libraries have been built at bases designated as Volar bases - Fort Campbell, Kentucky and Fort Ord, California. While they are far short of space in terms of what might be expected in a civilian library serving a comparable user population,* they do represent a great step forward from older library facilities. Service has been improved simply because more adequate physical facilities are now available, and crowding of staff, materials and users has been minimized. The contrast between the use of the old and new facilities may be of value to technical libraries by providing evidence on how a new facility affects service.

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* Tables of space allocation standards are given in A.V. and B.V.

The Fort Ord Library was housed in a firehouse until Chamberlin Library was constructed, and Fort Campbell's old library occupied two floors of a service club building. A review of the service levels, circulations, users, interlibrary loans, etc., before and after the new buildings were completed might provide some useful information. If significant differences in use exist, technical librarians may be able to use the results to demonstrate what a new adequate facility would mean to their own library performance. As almost all of the technical libraries occupy space within an existing structure, and almost without exception the spaces available are very inadequate, any evidence to demonstrate how adequate space and facilities would improve their service would seem helpful.

Both the Fort Ord and Fort Campbell facilities (see plans on pp.40-41) represent deviations from the standard plans. Fort Ord accepted the exterior configuration, a rectangle, and determined the interior design form on the basis of local needs and preferences. Even the exterior elevations are modifications of the usual stark military treatment. Fort Campbell represents a total departure from the standard plan. Local architects and an independent interior designer were employed. Almost all of the furniture and equipment are non GSA. The resulting facility, like all facilities, has its faults, but is an excellent library. The atmosphere is outstanding, making it a very inviting place to work, and it appears to be well used. The contrast between this library and the hospital library on the same base is very marked. The hospital library uses GSA equipment, and overall the atmosphere is much less pleasant. The Fort Ord and Campbell facilities demonstrate what can be done using a more flexible design process, and hopefully indicate future directions for the design of post and camp libraries.

Summary

Each of the libraries discussed above exhibited problems similar to those other military and Federal libraries visited or studied during the course of this project. The specifics may vary but the overall picture remains constant. Exclusive of costs, priorities, etc., planning problems arise from these common factors:

a. consequences of predetermined external configuration of the space to be used

b. discontiguous spaces employed for services that ought to be contiguous

c. space shared with other organizations

d. space allocations which do not reflect all the needs of the library

e. floors not designed to carry loads as heavy as required for library stacks

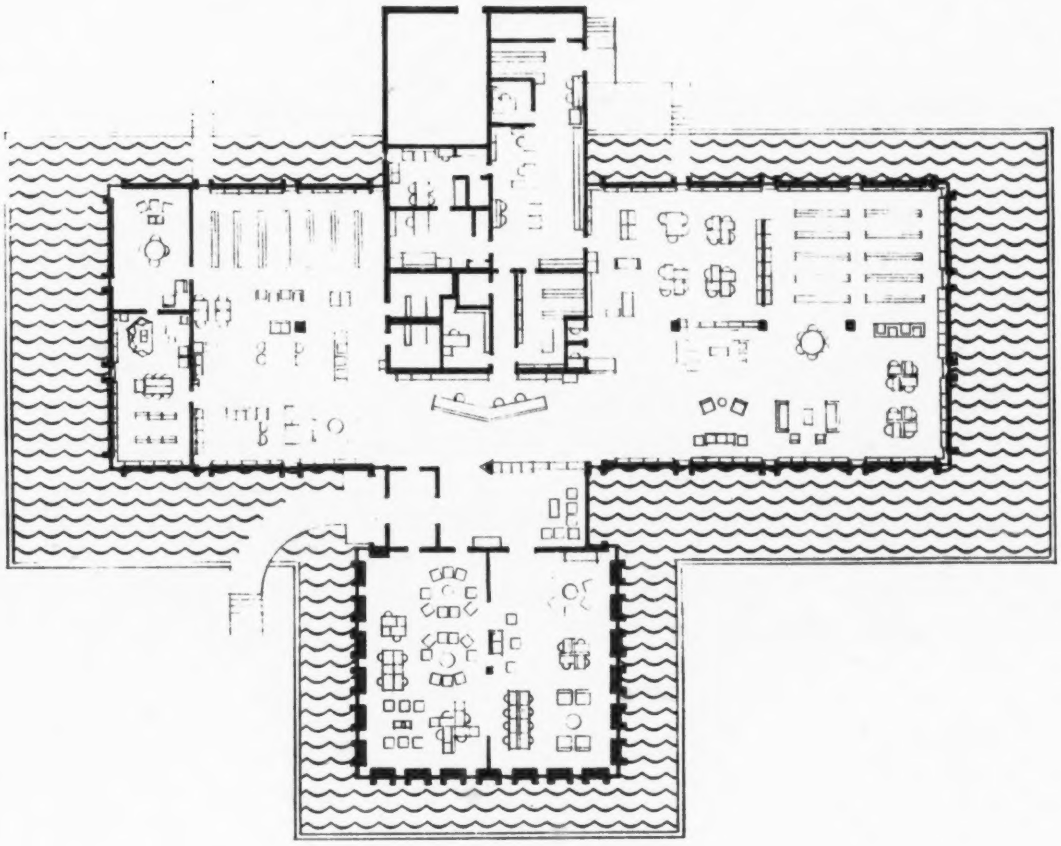
f. fixed walls, ducts, utility areas within the library area

g. requirements to use standard government furniture.

In other libraries some or all of these factors were evident. Some of the other Army libraries visited were Redstone Arsenal, the Plastics Information Center - Picatinny Arsenal, and West Point Military Academy. These Army libraries are equivalent to the full range of civilian libraries with the exception of school libraries. However, in the main post or camp library there is a strong element of the school library with childrens' services much in evidence, thus completing the full spectrum. Other military libraries were also visited (4 Naval and 2 Air Force) and reflected the same problems. This was also true of other Federal libraries we toured. The many non-Federal libraries visited, both in separate facilities and those within larger buildings, served to reinforce the view that the planning and design process is really generic in nature.

FORT CAMPBELL LIBRARY

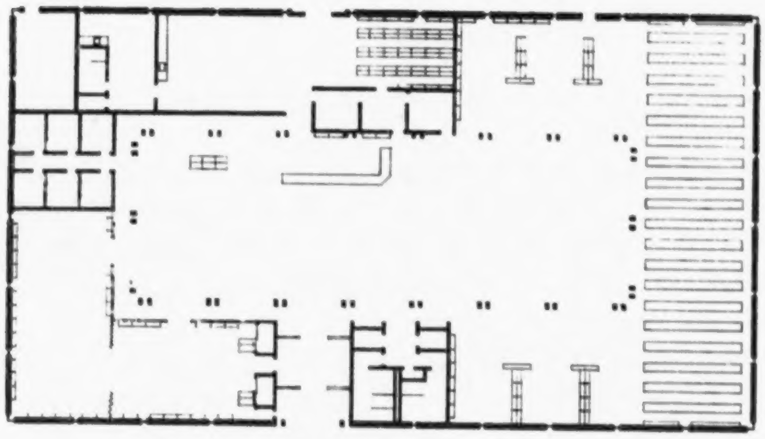
FLOOR PLAN scale 1" = 50'

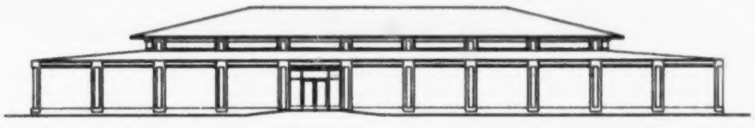


FORT ORD LIBRARY

FLOOR PLAN & ELEVATION

scale 1" = 50'





IMPLEMENTATION A.III

HOW HAVE ARMY TECHNICAL LIBRARIES BEEN BUILT?

The determination of goals and objectives, the establishment of standards and requirements, and their interpretation into a particular design to suit the conditions of a particular library on a particular site, are all logical steps in a rational overall process of implementation. The process, however, includes additional important decisions which have a significant bearing on both the quality of the library and the time when it becomes available to its users. These include approvals at various levels of the administrative hierarchy, relationships to broader mission goals, funding procedures, costs, construction, programming, etc. This part of the report is concerned with these issues, as they exist currently within the Department of the Army, and considers them in relation to the other Service Departments.

Library building procedures in the two Department of the Army categories are discussed. The first includes those which provide a specialist service to a particular branch or unit, e.g., technical, academic, and other specialist libraries. The second includes post and camp libraries, i.e., those provided for recreational purposes on Army installations.

Facility Procurement Procedures

To obtain a better understanding of the problems inherent in current implementation efforts, it is necessary first to describe the major conditioning factors and steps in the total facility procurement process. Variations within this process, as they affect technical libraries, will then be discussed.

The Military Construction, Army (MCA) program consists of construction project proposals from the entire Army establishment, including all programs in Continental USA (CONUS) and those in overseas bases.

The Headquarters, Department of the Army (HQDA) is responsible, within the Department of Defense (DOD) Program system, for the preparation of a "Five Year Defense Program" (FYDP), which is

> "designed to provide a phased construction program which is consistent with current mobilization plans, existing resources and budget objectives. Separate annexes to the Five Year Defense Program entitled 'Construction', 'Materials', and 'Family Housing', are the

> basis for the more detailed Program and Budget Guidance which outlines the missions and levels of activities to major Army commanders and agencies, which in turn, through operating programs and other media, prescribe strengths and missions to their various installations and activities." (4)

They also issue annually, by letter, guidance for the target budget year MCA program, which is always projected two years in advance of the date of the issuance of the guidance, i.e., guidance for programming for Fiscal Year 1973 is promulgated at the beginning of Fiscal Year 1971. The target guidance is developed for HQDA staff, based upon force levels, prior budget planning, and anticipated budget ceilings.

At permanent installations in the USA the Five Year Defense Program and target budget year are received by the major command, which proceeds to distribute the dollar package to the intermediate commands under its jurisdiction, which in turn, distribute target guidance to the installations for which they are responsible. These dollar distributions have been developed from previous tentative construction requirements that have been submitted to and processed by superior commands in earlier years.

At all permanent installations, three construction programs exist: 1. A Long-Range Construction Program (LRCP); 2. An Intermediate-Range Construction Program (IRCP); 3. A Short-Range Construction Program (SRCP).

The LRCP contains the total construction requirements remaining beyond the IRCP that are required to fulfill the provisions of the installation's Master Plan. It is assumed that this program is to be accomplished, at least theoretically, in 20 years.

The IRCP contains the SRCP, plus the construction requested for the four succeeding fiscal years, i.e., the projects necessary to fulfill the Five Year Defense Plan objectives. Therefore, for planning purposes during fiscal year 1971, the IRCP would include the fiscal years 1973 through 1977.

The SRCP is the new fiscal year program being developed for submission to the Congress, i.e., for planning purposes in fiscal year 1971; the target year is fiscal year 1973. It is therefore, the same as the "budget year plus one" in the Five Year Defense Plan, and the first year of the IRCP, and represents those projects of the highest priority with which the installation is most immediately concerned, and as determined by the major commanders.

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(4) AR 415-15, p. 1-2, para. 1-4, The Construction Programming Process. a. MCA program development, 1 July 1969.

The LRCP, or the Master Plan, is essentially static after its provisions have been approved by HQDA. The other two programs, IRCP and SRCP, however, are revised and prepared each year by an Installation Planning Board for eventual inclusion in the Army's new construction programs (MCA).

The steps involved in the preparation of these programs, and their effect on the timing of projects, are indicated on the following MCA Cycle Chart, being a network diagram of the preparation, justification, submission and approval process and its accompanying task, (p. 49). As the network applies to the whole installation, library facilities are automatically included within these stages.

At each installation construction requirements are determined in accordance with Master Planning procedures described in AR 210-20. Once the installation commander has received his target fund guidance (Step 1-3) from the appropriate Major and Intermediate Commands, he establishes an Installation Planning Board (IPB) to assist him with the development of the installation Master Plan, in accordance with the strengths, workloads and missions assigned to his installation (Step 4). The constitution of the IPB is clearly defined for him, and would probably include the librarian as a voting member, as the

> "representative of each major or technical staff section of the installation and any other regular members desired by the installation commander concerned." (5)

It is obvious that it is vitally important for the librarian to be fully involved and active at this time, for not only are final decisions being made in effect about the details of the facility, but as can be seen from the network, the next occasion in the MCA process when the librarian is involved is when he takes possession of the completed library, anytime up to five or more years later.

The following text, p.45 to 48, presents a detailed explanation of the graphic representation of the Military Construction Cycle found on page 49. By folding out the chart one can follow both the text and the chart.

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(5) AR 210-20, p. 1-2, para. 1-5. Installation planning boards. a. (2) (b). Master-planning for permanent Army Installations, June 1969.

STEP NO.	DESCRIPTION OF ACTION
1.	Mission and strength guidance issued in stationing plan.
2.	Mission and strength guidance received.
3.	Mission and strength guidance received.
4.	Development of Master Plan.
5.	Contribute to Master Plan by establishing Installation Planning Review Board.
6.	Review and revision by Command Planning Review Board, forward to HQDA.
7.	Approval and issuance of program guidance of the Short Range Construction Program and Intermediate Range Construction Program to installation via the major and intermediate commands.
8.	Program Guidance received.
9.	Program Guidance received.
10.	Program Guidance received.
11.	Program Guidance received.
12.	First Program Guidance received.
13.	Additional intercommand preliminary guidance supplied.
14.	DA staff supplies more specific guidance.
15.	Contributes as member of Installation Planning Review Board.
16.	Projects that will best meet their plans; projects are aligned in priority sequence. Post engineer prepares a DD Form 1390 for each project (cost estimates, etc.). A ten paragraph justification is prepared for each short range project, after this a DD Form 1391 is prepared (a composite listing).
17.	Examines program; puts it in a composite with others submitted.

18. Major command considerations, policies and requirements are applied, and priorities realign intermediate packages into an overall construction program.

19. Reviewed for accuracy, completeness and technical sufficiency, incorporated into a total construction plan.

20. Submitted to construction requirements review committee (composed of representatives of the principal staff sections of the DA and OCE) to formulate annual target budget year program. Program is then reviewed and approved by the DCS Log.

21. Last minute refinements in justification arguments and final updated cost analysis.

22. Commence concept designs.

23. Reviews DCS Log package.

24. Review and approval.

25. Review and approval; and submission as part of proposed Army budget.

26. Review jointly with OMB. A list of requirements is generated by OSD and the approved version of the new construction plan is developed.

27. Handed down for inclusion in the final OSD-approved Army budget for the target year, or for reclamation if desired (on those projects disapproved that the Army feels should be included).

28. Final review.

29. Final smoothup.

30. Commence final design action on OSD-approved projects.

31. Submits OCE prepared program.

32. Forwards OCE prepared program.

33. Committee (House and Senate Armed Service Committees) project authorization deliberations. A 200 word summary ("boilerplate") is prepared on each DD Form 1391 to familiarize committees on projects.

- Submitted to Appropriations Committees next.
- Completion of hearings, passage of a bill.

34. Signature and enactment.

35. Prepares MCA program execution circular (based on information from Congressional committee staffs indicating the characteristics and magnitude of final program).

36. Forwards circular to District Engineer to be used as a guide for scheduling.

37. Prepares construction and contract schedules in anticipation of forthcoming authorization and funding.

38. Preparation of apportionment request.

39. Apportionment request forwarded to OMB via OSA and OSD

40. Submits apportionment request to OSD.

41. Submits apportionment request to OMB.

42. Funds apportioned in consonance with Congressional appropriation via OSA, DCS LOG, COA (Comptroller of the Army) and OCE.

43. Forward notice of apportioned funds.

44. Forward notice of apportioned funds.

45. Forward notice of apportioned funds.

46. Program execution commenced.

47. Occupancy.

MCA CYCLE

Explanation of Abbreviations and Terms

OMB - Office of Management and Budget

OSD - Office of the Secretary of Defense

OSA - Office of the Secretary of the Army

CSA - Chief of Staff, U. S. Army

PBAC - Program Budget Advisory Committee

DCS LOG - Deputy Chief of Staff, Logistics

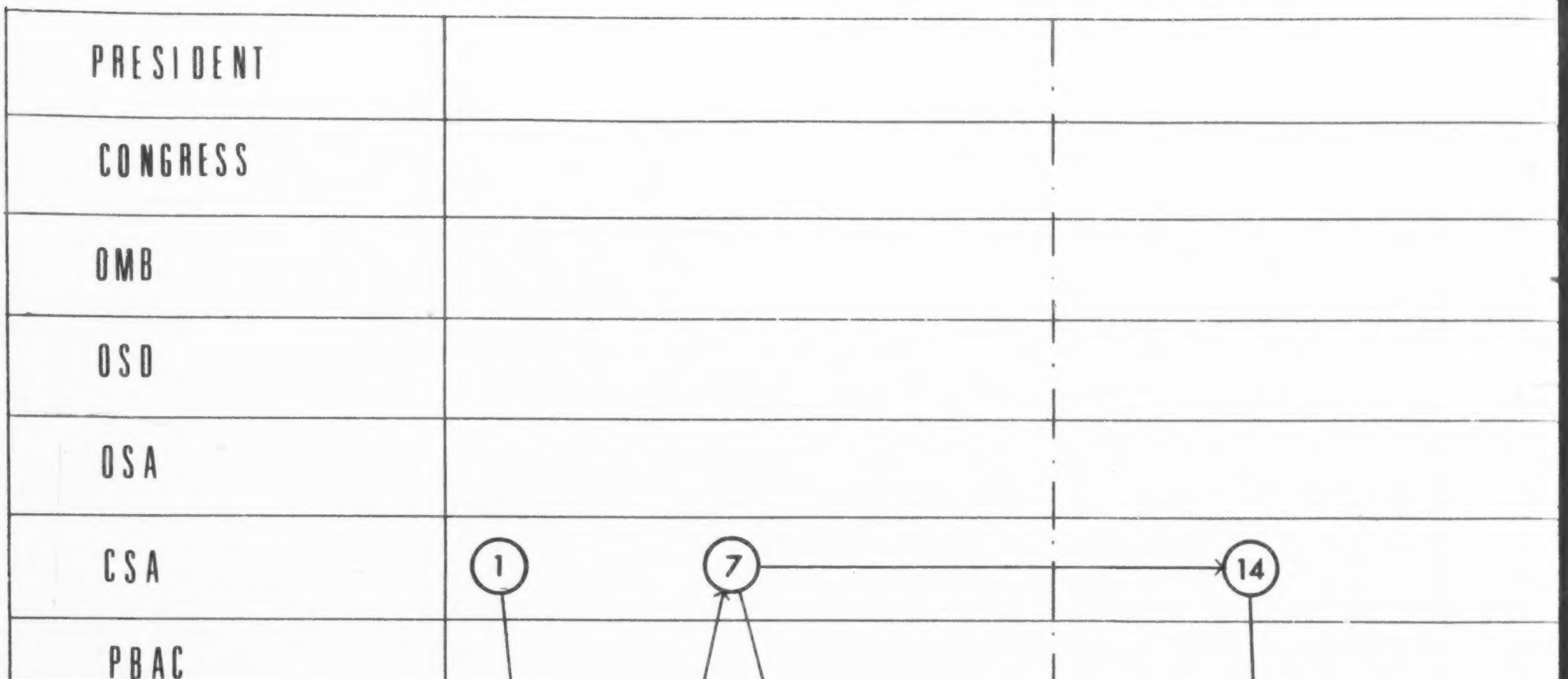
OCE - Office of the Chief of Engineers

FY - refers to the Fiscal Year in which the program is to be appropriated.

MAJOR COMMAND - Planning Review Board whose composition and function reflects the features of the Planning Review Board at the intermediate command level described below.

INTERMEDIATE COMMAND - Planning Review Board, composed of the Chief of Staff and the principal members of each staff section, to provide information to installations within the command concerning assignment and transfer of missions, activation and deactivation of units, and military and civilian strengths to be used as a basis for developing the Master Plan.

INSTALLATION - Commanders of permanent installations establish Installation Planning Boards for development and maintenance of approved Master Plans. Voting members are normally a senior representative of the installation commander, the post engineer, a representative of the division engineer, and representatives of each independent activity that is a tenant on the installation and for which the installation is responsible for the reporting of real military property (i.e., the librarian).


PRESIDENT
CONGRESS
OMB
OSD
OSA
CSA
PBAC
DCSLOG
OCE
MAJOR COMMAND
INTER. COMMAND
DIST. ENGINEER
INSTALLATION (librarian)
TIME
1
2
3
4
5
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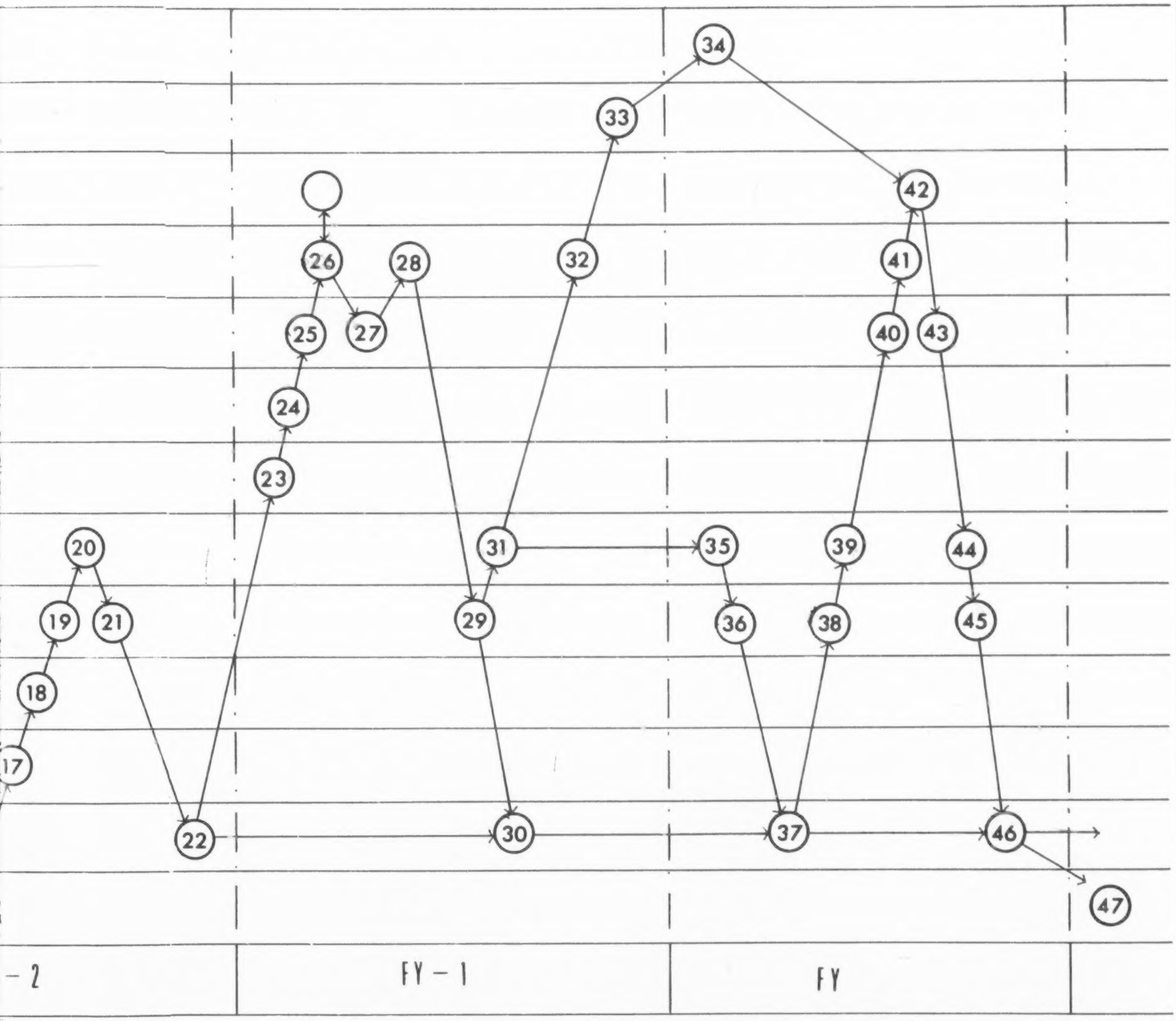
FY – 3
FY – 2


- 2
FY - 1
FY

MCA CYCLE

Technical, Academic and Other Specialist Libraries

The ultimate responsibility for the design and construction of technical, academic and other special libraries seems to rest with the Chief of Engineers.

> "The design of all major construction projects... will be accomplished by the Chief of Engineers." (6)
>
> "Designs of nonrepetitive facilities will be managed by the Chief of Engineers through..." (7)

However, their size and complexity most frequently influences the decision to award contracts for their design to outside consultants.

The general requirements of the MCA cycle are similar for Army technical and post and camp libraries. Responsibilities for decisions are distributed within the hierarchy, broadly parallel to those for post and camp libraries. Responsibility and authority remain, within MCA programs, with the President and the Congress, on the advice and recommendations of the Office of Management and Budget and the Secretary of Defense, who in turn, consider the proposals developed for them by their own departments.

However, a number of factors have a significant influence in determining the differences in the implementation process of technical libraries from post and camp libraries. The first is the recognition that each technical, academic or other special library is a unique problem requiring a unique solution. Unlike post and camp libraries, standard plans are not possible. The next concerns the greater complexity of needs, functions and organizations to be satisfied. This has a significant impact upon the procedures by which the criteria and requirements are determined, and in the development of the design solutions. In most cases it appears that a library specialist is retained as an additional member of this design team to write a building program. This frequently occurs prior to the appointment of an architect. The consultants are well-known to and respected by the library community, and have extensive experience working with architects. Their contributions and roles are described and discussed in B.II of this report.

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(6) AR 415-15, p. 3-2, para. 3-1. General. j. MCA program development, 1 July 1969.

(7) AR 415-20, p. 4, para. 6. Design management. b. Nonrepetitive facilities (1). Design approval, 20 February 1969.

The complex problems noted above have been further aggravated in the past by libraries being accommodated within large building complexes housing a number of Army functions. This has been true in the case both of existing buildings and newly constructed buildings. In every case, the requirements of the library have had to be adjusted or compromised to allow other criteria to be satisfied. The conditioning factors deriving from this situation include the effect of the building shape and configuration (e.g., Redstone Arsenal, HUD, Air Force Academy, etc.). Severe limitations in floor loading capacities (e.g., Redstone Arsenal) and disperal of accommodations on various floors or otherwise separated (e.g., Redstone Arsenal, Office of Management and Budget, Naval Research Laboratory).

It is obvious from the visits, interviews and discussions, and from analyses of plans of completed buildings, that results less than satisfactory to the librarians are being achieved.

The total effect, in terms of impact upon the efficiency of the library, is discussed elsewhere in this report. Part may be due to changing concepts about the roles libraries play, as well as about library facilities and equipment.

The impact upon the process of implementation, however, is also significant. The nature of the process is such that it generally takes the form of a series of discrete sequential stages, in which sets of decisions are being taken in isolation without necessarily having due regard to succeeding stages. This is made more complex when additional negotiations become necessary between a wider group of interests. Not only is more time taken up, but compromises are less easily reached or accepted, because there is really no satisfactory way of attributing priorities to quite disparate claims. With the absence of substantive evidence to support specific claims for his requirements, the librarian tends to be at a disadvantage from other claimants. The ultimate design stage, at which time all previous inputs and decisions must come together, therefore frequently becomes one of instituting compromises rather than satisfactorily fulfilling goals and criteria.

The effects of these factors are indicated on the accompanying network (page 54) which is a hypothetical case to indicate the kind of input on stages 4, 12, and 16 in the MCA Cycle. It assumes that the need for a technical library on a particular installation has been established and authorized by Chief of Staff, U. S. Army (CSA), and that this decision has been conveyed to the Installation Commander by way of Major and Intermediate Commanders. The district engineer, recognizing the complexity of the problem has been authorized to appoint outside consultants as necessary, including a library specialist (4.1) and an architect (4.2). He consults with the librarians and the installation engineer. If the technical library is to be accommodated within an existing structure on the installation, the appointment of an architect is likely not to be necessary; the librarian may still, however, feel the need for advice from a library specialist.

If it is proposed to accommodate the library in a new building, the chances are that it will be only a part of a larger complex for which the architect may have been appointed already.

In either case, consultation will have to take place with other users, either existing or proposed, to understand their needs and to relate them to those of the library {4.3}. Normally, it appears that this role falls to the architect {4.4} who reports his overall findings and proposals to the engineer, either at the installation or district level, depending on the level at which the original appointment was made {4.5 and 4.6}. Our findings indicate that at this stage, a space allocation is made known to the librarian {4.7} for his purposes, and he is expected to design his layout within this allocation. We found no single example in which the requirements of the library had been determined from a detailed analysis of the activities to be accommodated and the furniture and equipment to be used. In all instances it was assumed that the librarian could accommodate his needs within a space or spaces allocated to him. Inevitably, not being a designer, he required the assistance of a library specialist {4.8}. Inevitably this has led to discussions and negotiations of the differences that arose between adjacent users {4.10}. Inevitably this absorbs time and energy. The consequence has been an extended time period between project initiation and occupation up to as much as eight or more years.

Once the Master Plan has been proposed {4.11} it is processed through the engineer {4.12 and 4.13} to the intermediate command {5} in the usual way and is received back at the installation {12} in the form of a First Program Guidance. Changes that may have been instituted at higher levels will now impact the project and similar re-cycling, negotiating, changing, etc. will proceed as previously {12.1-12.6} until stage 16 can be implemented. This involves assignment of project priorities and the preparation of justification statements and cost estimates. This is a very key stage in the process because "using services" such as libraries are required to furnish the Chief of Engineers with

> "firm criteria (e.g., designation of units and functions, functional capacities, special features, detailed requirements and relationships and recommended siting) to field offices of appropriate construction services, so as to minimize changes, delays, and additional costs. Development and updating of criteria is to be in accordance with AR 415-20. Feasibility studies, when required to support any line item, will be accomplished by using services prior to including such project in the Short Range Construction Program. Using services will also coordinate preparation of DD Forms 1391 with the appropriate construction service field offices (e.g., U. S.

> Army Engineer Districts) with emphasis placed on developing the best possible cost estimates...Review of concept designs by using services will be in accordance with AR 415-20. After design has begun, changes in criteria or siting will be limited to those which clearly justify the additional costs and delays involved." (8)

The "using services" definition of "firm criteria" however, must also have regard to a general requirement specified in paragraph 3-g. (2) (b), page 3-2 of AR 415-15:

> "The criteria for permanent and semi-permanent construction does not envision separate buildings for each requirement. Fewer, larger, and more flexible buildings are needed to efficiently house Army functions. The tendency to program facilities designed to a high degree of specialization detracts from the program and makes future alterations to meet new or changing missions excessively expensive." (See DOD Construction Criteria Manual 4270. 1-M. TM 5-800-1 and TM 5-803-4).

There is also a requirement to use existing facilities whenever possible. (See AR 415-15, p. 3-1, para. d).

Subsequent stages are less significant because they are concerned with the direct implementation of the decision taken at this time and consequently upon the statements made by the librarian and his advisor.

The librarian is at a distinct disadvantage, both in regard to criteria and to cost as no firm and authoritative data exists to help him. The nature of this data is discussed in detail in A.V of this report. Suffice to note at this time that it is generally recognized that there is a high attrition rate between the number of libraries requested and those that are ultimately built. The exact rate over the years is difficult to establish for a number of reasons, including:

1. Libraries are not always easily identifiable in building programs as they are frequently part of a larger facility or complex.

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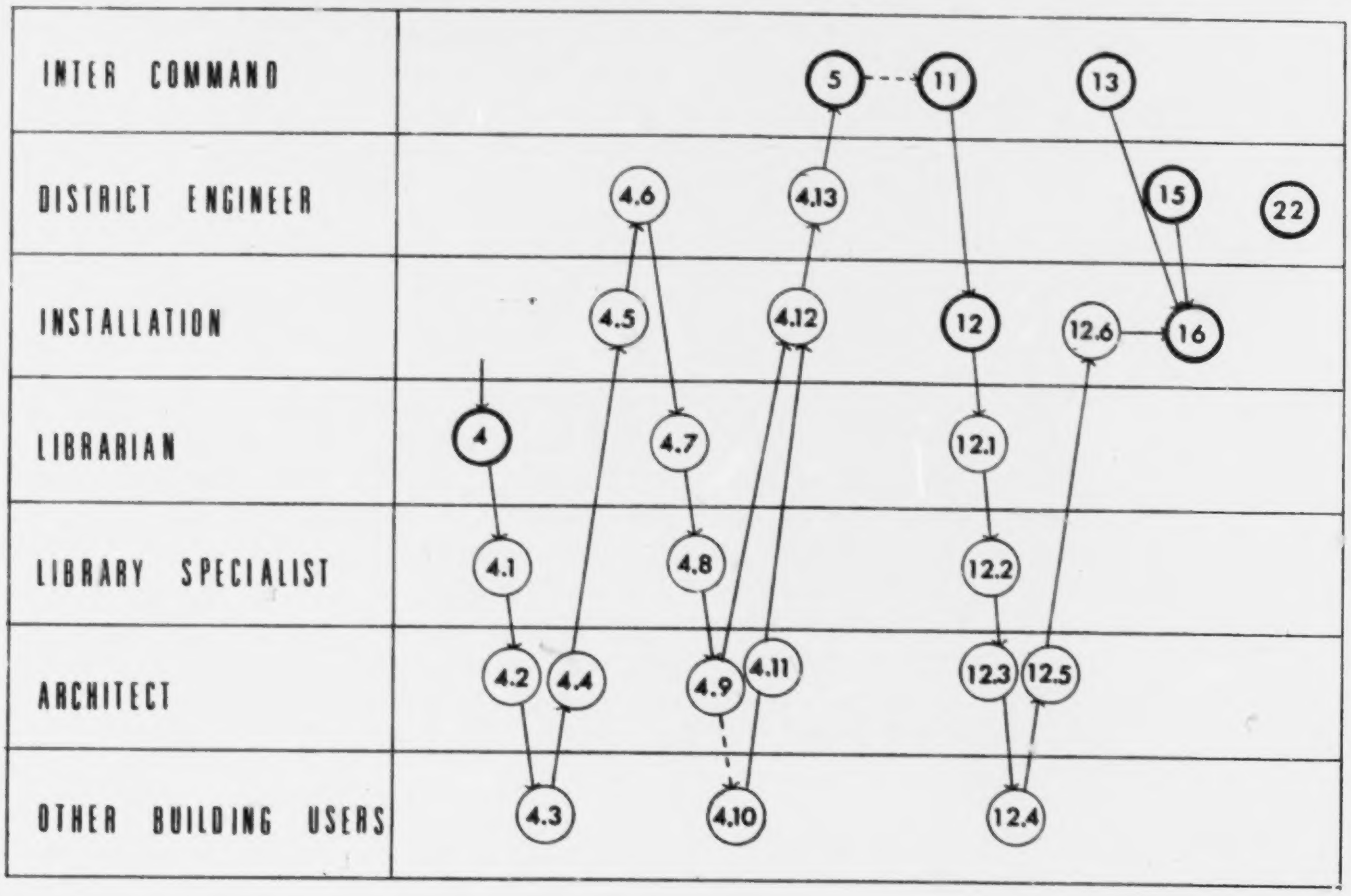
(8) AR 415-15, p. 3-2, para. 3-1 (j). MCA program development. 1 July 1969.

MCA SUBSYSTEM


INTER COMMAND
DISTRICT ENGINEER
INSTALLATION
LIBRARIAN
LIBRARY SPECIALIST
ARCHITECT
OTHER BUILDING USERS
5
11
13
4.6
4.13
15
22
4.5
4.12
12
12.6
16
4
4.7
12.1
4.1
4.8
12.2
4.2
4.4
4.9
4.11
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4.3
4.10
12.4

2. Changes in mission goals, economic conditions, etc., that occur between the preparation of a long range program and implementation of a current program can and have had significant impacts on those facilities not of the highest priority.

3. It is only recently that computer programs have been developed to maintain records of annual changes in programs that are reasonably comprehensive and in sufficient detail.

However, it is perhaps significant and indicative of the attrition rate experienced in recent years that, according to a computer printout supplied for this study, not one of the thirteen libraries originally proposed for construction in the Fiscal Years 70-72 has been funded. Nor have any of the eleven Community Centers which could conceivably have accommodated post and camp libraries. This could be attributable directly to inadequate information on which to base requests. It is obvious that considerable improvement is both desirable and achievable.

Post and Camp Libraries: Procedures for establishing design criteria

The requirements, both physically and procedurally, for post and camp libraries, unlike technical libraries, are very fully documented and prescribed. They are contained in a series of Army Regulations and supporting Engineering Regulations, Pamphlets, Technical Manuals, DOD Instructions, Engineering Manuals, Federal Specifications, etc., that apply to the Military Construction Army (MCA) programs.* Of the full range of buildings provided at Army installations, post and camp libraries are included within the category of Community Facilities. This general category is recognized as having a lower priority than other mission-oriented facilities. The following quotation (to which underlining has been added) evidences this:

> "b. Community facilities have generally been considered by higher headquarters as lower priority than barracks, BOQ, and messhalls. Programming by barracks complexes has helped but there are still large deficiences in permanent post community support items such as post chapel, post gymnasium, post field house, E M Service clubs, theaters, libraries, auditoriums, general education buildings, main post exchange and commissary. Since

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* Specifically: AR 415-15. MCA Program Development. AR 210-20. Master Planning for Permanent Army Installations. AR 415-20. Design Approval. AR 415-35. Construction. Minor Construction.

> these items tend to be considered as 'nice to have' rather than 'operationally urgent' they suffer in competition with other higher priority items when budgets are limited. Justification must, therefore, be as specific and detailed as possible." (9)

Currently, however, the standards for post and camp library facilities are also indicated in the sets of "definitive plans", which have been discussed earlier. The apparent similarity of requirements for post and camp libraries and their equivalents in the other two Services has led to the setting up of the Tri-Service Committee which is developing new proposals for revised space standards. The process being followed still assumes that requirements can be expressed in an allocation of square footage of floor area. This is unrelated specifically either to the range of activities being undertaken in the library, or to the furniture and equipment that might be available. Alternative methods which more clearly articulate the needs of the library and which, therefore, would "be as specific and detailed as possible"* might be more effective in contributing to its provision in the future.

Beyond the statement of the needs, however, the complexity and lengthy nature of the facility procurement procedures in the MCA Cycle also seem to mitigate against the provision of libraries, as has already been discussed.

As the librarian's contribution is already prescribed by the notion of definitive plans based upon a square-footage allocation, and an edict to use existing facilities whenever possible, and as the process is so time-consuming, so that many changes in both scope and requirements are inevitable during the period, it becomes particularly important to develop flexible solutions in the future, in terms of both hardware and procedures for post and camp libraries also, and to base them upon supportable evidence.

Costs and Timetables

Costs of constructing facilities are radically affected by time, as well as by location, the availability of manpower and materials, the quality standards established, and the efficiency of the building design. Not only do financing charges increase, but general inflation affects administrative and professional costs. Embarrassing discrepancies between cost estimates and bids all too frequently require either the elimination of the project, or the introduction of drastic reductions in accommodations and quality. Every effort therefore needs to be made to affect savings in overall implementation times.

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(9) AR 415-15, p. 3-5, para. 3-10 (b). MCA program development. 1 July 1969.

* See reference (9).

According to the Engineering News Record (ENR), in June 1971 the Building Cost Index nationally stood at 13.2% above June 1970, and it is observed that the construction industry is "currently deep in the mire of its worst cost inflation in more than two decades." (10) This conclusion is borne out by other indexes generated by Turner Construction, Fuller Construction, etc. It is vitally important, therefore, if the best cost-benefit ratios are to be obtained, that more effective cost planning and control techniques are developed for the design of libraries.

There are excellent precedents for these, both in the United States and abroad, and they should be considered in detail in Phase II so as to establish procedures in which expenditures and budgets can be designed in parallel with "building design".

Historical price data about Army technical libraries is both sparse and sporadic, making it difficult, if not impossible to draw any conclusion or offer any substantive opinions on whether or not the best cost-benefit ratio was obtained in any particular instance.

According to Jerrold Orne (11) the average project costs (buildings and equipment) per square foot for libraries costing (a) over \$2 million, (b) between \$1-2 million, and (c) under \$1 million in 1967/68 were \$27.40, \$25.24, and \$23.79 respectively. Applying the ENR Index, their equivalent costs per square foot in 1971 would have been \$37.76, \$35.49 and \$33.51 respectively.

These compare with \$37.20 per square foot for a projected Army Research Troop Library, and with an adjusted figure of \$40.04 per square foot for a USAAVNS library. This would suggest that costs of Army technical and educational libraries compare reasonably with those of universities. The absence of separate costs for post and camp libraries made it impossible to compare these with their equivalents - public libraries - in the private sector.

The general position of difficulty in judging costs is made more difficult in the case of libraries which are part of larger building complexes. Here it is virtually impossible to separate out unique library costs.

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(10) Second quarterly cost round-up; contractors face rising costs on all fronts. In: Engineering News Record, 186:24 (17 June 1971) p. 80.

(11) Orne, Jerrold. Financing and cost of university library buildings. In: Library Trends, 18:2 (October 1969) p. 150-165.

Costs are also a dominating factor in the life of a building. Apparent savings in initial costs, if achieved through inferior products or workmanship, can generate escalating expenditures in operation and maintenance in all the successive years of the library's life, as these are composed substantially of labor costs. Unfortunately, the position is aggravated for two reasons. First, organizational, administrative and capital costs, and operating and maintenance costs are most frequently the responsibilities of different authorities, and are seldom considered within the same decision framework. Secondly, records of true operating and maintenance costs are inadequate, if they exist at all.

Until such time as both cost aspects are considered together, there is little effective incentive to institute savings which are meaningful over lifetime use. It is strongly recommended that the examination of related costs (capital, operating, etc.) is included in Phase II, in terms of procedural implications, assessments of current practice and data, and the establishment of new methods for the future.

Because of the relationships between capital and operating costs are not fully understood by the architect or the librarian, the planning team is deprived of essential information when deciding between alternative designs. Erroneous cost assumptions and consequent discrepancies and disappointment can also mean considerable delay and frustration in attempts to rectify them.

Another aspect of the Army process which affects costs relates to the provision of facilities in larger buildings. Frequently the library does not move into a new building along with other new tenants, but rather takes over space originally planned for other purposes, and this despite the fact that one of the most expensive forms of construction is remodeling-renovation work. Often, because of these high costs, remodeling will be required to be kept to a minimum, making the resulting facility even less satisfactory than it might otherwise have been. Once it has been decided that money is to be spent in providing library services, the aim must be to create the best possible environment and obtain the best cost-benefit ratio.

The table on page 59 indicates the variation in advice about relative costs. It indicates that no common format exists, and that there is no convention about which items should be included, and what level of detail should be developed. This is another area that requires additional effort in Phase II if satisfactory advice is to become available to administrators and librarians in the future.

COSTS

PERCENTAGE OF TOTAL PROJECT

	1	2	3	4	5
GENERAL CONSTRUCTION			60-65%	60-65%	
SITE WORK		5-10%			
AIR CONDITIONING			15%	10-14%	
PLUMBING				2-7%	
MECHANICAL AND ELECTRICAL			3-8%	7-11%	
OUTSIDE WALLS			9-10%		
FURNITURE	10-15% or $2-3/sf		15%	10-15%	10-15% or $2-3/sf
CONTINGENCY FUND		10-15%			10%
ARCHITECT FEE ($100,000 STRUCTURE)			4-12%	6-10%	

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

1. Verley, Alain. Equipment and layout of library buildings. In: The Bookmark, 20:3 (December 1960) p. 72.

2. Tappe, A. Anthony. Guide to planning a library building. Huygens and Tappe, Inc., Boston, 1968, 49 p.

3. Metcalf, Keyes D. The use of hindsight in planning library buildings. In: Libraries: building for the future. A.L.A., Chicago, 1967, pp. 3-8.

   ______________ How to avoid common mistakes in planning libraries. In: College and University Business, 36:3 (March 1964) pp. 54-7.

   ______________ Library lighting. Association of Research Libraries, Washington, D.C., 1970, 99 p.

4. Galvin, Hoyt; Van Buren, Martin. The small public library building. UNESCO, Paris, 1959, pp. 56, 83.

5. Jenkins, Joseph A. Programming and financing library buildings. In: Libraries: building for the future. A.L.A., Chicago, 1967, pp. 34-8.

EVALUATION A.IV

HOW HAVE ARMY TECHNICAL LIBRARIES BEEN EVALUATED?

The entire field of evaluation of library plans and physical facilities is virtually unexplored. This is also true of Army technical libraries; there is no formal review procedure. A few individual librarians may, from time to time, subjectively evaluate their own facility. No doubt some evaluation takes place when laying out a new library. On the basis of interviews and discussions with librarians in all types of library work, including some of the leading library building consultants, it is very clear the entire process is a hit and miss subjective procedure.

It is assumed that library building consultants pay return visits to completed facilities. One purpose would be to determine how successfully the building program had been implemented. Unfortunately, this type of evaluation is also highly personal, subjective and not necessarily instituted. We found no evidence that the Corp of Engineers institutes any objective analysis procedure for library facilities. Whether or not this procedure is to blame for the results is a moot point; however, very few libraries, including Army technical libraries, are considered good functional facilities by their staff or users.

One essential characteristic of the proposed work in Phase II is the development of a Guided Inquiry System in which decisions are not only effectively taken, but can be fully evaluated, in measurable terms, in the context of completed facilities.

DATA COLLECTION A.V

WHAT STANDARDS HAVE BEEN USED FOR ARMY TECHNICAL LIBRARIES?

General Space Allocation - Army Libraries

There are several sources of information regarding general space allocations for Army libraries. In most cases Army regulations AR 415-31, AR 415-36, AR 415-50 and Department of Defense manual DOD 4270.1M (see table on page) determine the space allowances for the library, even though none deals explicitly with Army technical libraries. Each source is very specific in the allowances granted but, as can be seen, they only cover space for users and books. Most of the recommendations for calculating space needs include more variables (see the discussion of space allocations for civilian libraries in B.V). The more variables considered the more likely the space will be adequate. One could imagine for many Army libraries that such factors as climate, distance between buildings, specific mission, availability of other recreational and study facilities, all influence the amount and duration of use of the library. By extension then, these factors also affect the amount of space needed.

Perhaps the best summary of the situation is found in the Tri-Service Committee report outlining the need to revise the space standards. Points 2, 3 and 5 are applicable to Army technical libraries.

> "Rationale for Revision
>
> 1. No provision is made for adequate size buildings for large installations over 16,000 military strength. Current criteria force large installations to establish branch libraries which, though showing high operating cost, still do not duplicate the materials and services of the main library. Large installations should have the option, depending on local conditions, of concentrating most of their library functions in one large library in order to reduce operating costs.
>
> 2. No allowance is made for library service to dependents of military personnel, civilian employees, and other non-military personnel in the military community who are permitted to use library facilities.

Individuals not in uniform constitute 50 percent or more of the total population of most military communities. Reduction of library services to military personnel will result unless space criteria are increased to allow for the total population to be served. The alternative or restricting use of post library facilities to only military personnel would be unacceptable and would undermine efforts to increase the attractiveness of the armed services as a career.

3. Current criteria allow inadequate space to meet the broad mission of post and base libraries. Collections and types of library materials must be expanded, in some instances doubled or more; study and reference facilities and a great variety of audio-visual services and equipment must be added to the libraries in order to respond to the rapidly changing educational, social and technological environments affecting the armed services. Adequate support to expanding education programs and the required scope of mission-related information services and technical materials cannot be provided within current constraints on library facilities.

4. An example of the inadequacy of current space criteria is provided by the new main library at Fort Campbell, Kentucky, which was completed in 1966 with the maximum allowable space of 14,400 square feet. This library serves a military community of approximately 50,000 people. It is the only library on the installation. By American Library Association standards for small public libraries, a library serving this size community should have 30,000 square feet and provide 100,000 volumes. The new Fort Campbell library has reached its capacity of 45,000 volumes.

5. No provision is made for additional space when a library is delegated responsibility for an additional function such as serving as a base for a bookmobile or as a command

reference center providing specialized reference and interlibrary loan services to several library systems.

6. DOD Inst 4270.1 does not include a facility for a library service center. These facilities provide a valuable service in some areas, primarily overseas, and offer a means of saving operating costs by centralizing some technical functions. Under appropriate conditions the establishment of library service centers in CONUS would be a means of reducing library costs. Proposed space criteria for these facilities have been prepared based on experience in the overseas centers and should be included in revised DOD space criteria." (12)

Security Vaults

We have been unable to locate any Army or Air Force regulations for security vaults, but assume these exist, perhaps in classified documents. Vault specifications for Naval libraries were provided for us by the Naval War College. These are quoted in their entirety. (13)

"Vaults

1. Vaults shall conform to the specifications described below:

   a. Class A Vault.

      1. Floors and Walls. Eight-inch thick[1] reinforced concrete. Walls to extend to the underside of the roof slab above.

      2. Roof. Monolithic reinforced-concrete slab of a thickness to be determined by structural requirements, but not less thick than the walls and floors.

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(12) Tri-Service Committee. Proposed revision to criteria. Mimeographed, n.d.

(13) Department of the Navy. Security manual for classified information. Op Nav Instruction 5510.1c, 16 February 1971, p. D-3,4.

3. Ceiling. Where the roof construction is not in accordance with paragraph (2) above, a normal reinforced-concrete slab will be placed over the vault area at a height not to exceed 9 feet.

4. Vault Door and Frame Unit. The vault door and frame shall conform to Interim Federal Specifications AA-D-00600a (GSA-FSS), Door, Vault, Security, Class 5.

b. Class B Vault.

1. Floor. Monolithic concrete construction of the thickness of adjacent concrete floor construction, but not less than 4 inches thick.

2. Walls. Not less than 8-inch-thick[1] brick, concrete block, or other masonry units. Hollow masonry units shall be the vertical cell type (load bearing) filled with concrete and steel reinforcement bars. Monolithic steel-reinforced concrete walls at least 4 inches thick may also be used, and shall be used in seismic areas.

3. Roof. Monolithic reinforced-concrete slab of a thickness to be determined by structural requirements.

4. Ceiling. Where the roof construction is not in accordance with (3) above, a normal reinforced-concrete slab will be

---

[1] Where vault walls are part of exterior walls, the vault wall should be set back of the exterior part of the exterior wall to allow 4 inches of the normal wall facing to cover the vault wall.

placed over the vault at a height not to exceed 9 feet.

5. Vault Door and Frame Unit. See paragraph a. (4).

c. Class C Vault.

1. Floor. See paragraph b. (1).

2. Walls. Not less than 8-inch thick[1] hollow clay tile (vertical cell double shell) or concrete block (thick shell). Monolithic steel-reinforced concrete walls at least 4 inches thick may also be used, and shall be used in seismic areas. Walls back of the exterior wall-faction of the building shall be concrete, solid masonry, or hollow masonry units filled with concrete and steel reinforcement bars.

3. Roof. See paragraph b. (3).

4. Ceiling. See paragraph b. (4).

5. Vault Door and Frame Unit. The vault door and frame unit shall conform to Interim Federal Specifications AA-D-00600a (GSA-FSS), Door, Vault, Security, Class 6.

2. Safety and Emergency Devices.

a. A vault used for the storage of classified material shall be equipped with an emergency escape and relocking device. The escape device, not activated by the exterior locking device, accessible on the inside only, shall be permanently attached to the inside of the door to permit escape for persons inside the vault. The device shall be designed and installed so that drilling and rapping of the door from the outside will not give access to the vault by actuating the escape device. Those vault doors conforming to Interim Federal Specifications AA-D-00600a (GSA-FSS) will meet this requirement.

b. A decal containing emergency operating instructions shall be permanently affixed on the inside of the door. Each vault shall be equipped with an interior alarm switch or device (such as a telephone, radio, or intercom) to permit a person in the vault to communicate with the vault custodian, guard or guard post so as to obtain his release. Further, the vault shall be equipped with a luminous-type light switch and, if the vault is otherwise unlighted, an emergency light shall be provided.

3. Structural Design.

In addition to the requirements given above, the wall, floor, and roof construction shall be in accordance with nationally recognized standards of structural practice. For the vaults described above, the concrete shall be poured in place, and will have a minimum 28-day compressive strength of 2,500 p.s.i.

4. Light Room and Heavy Room Vaults.

Vaults referred to in earlier editions of this Appendix as light room and heavy room vaults may be easily converted into one of the Class Vaults listed above. Until the light room or heavy room vaults are converted they may continue to be used for classified stowage. However, no more than 15 points shall be assigned for any vault not equipped with a GSA approved security vault door."

GENERAL SPACE ALLOCATION

ARMY LIBRARIES

	1	2	3	4	5	6**
		MAIN pop served sf 1000-2500 1500* 2501-5000 4200** 5001-10,000 8550** 10,001-20,000 9000 20,000-up 13,200 BRANCHES 3200 sf max after 10,000 1/5000 pop	pop served sf up to 500 * 501-1500 2500 1501-2500 4800 2501-4000 6000 4001-6000 7800 6001-8000 8800 8001-12,000 10,300 12,001-16,000 12,700 over 16,000 14,400	MAIN same as column 2 BRANCHES 4000 sf max after 10,000 pop 1/3000 pop	pop served sf 25-250 250 251-500 500 501-1000 1000 1001-5000 4180 5001-10,000 7880 ***	pop served sf up to 500 2500 501-1500 4500 1501-2500 6250 2501-4000 8000 4001-6000 10,000 6001-8000 12,000 8001-12,000 18,000 12,001-16,000 20,800 16,001-20,000 24,000 ****
STUDENTS	seat 25% of undergrad seat 15% of technical					
STAFF	11% of total net area					
MATERIALS	100 vol/6.6 sf add 30% for growth					vol sf 40,000 6000 60,000 10,000 80,000 13,000 100,000 16,000 120,000 19,000 140,000 22,000 160,000 24,000 180,000 26,000 200,000 28,000
NON-ASSIGNABLE	27%					

* to be provided in other facilities @ 3 sf/person

** standard drawings exist

*** up to 1000 pop. incorporate library in other facilities.

**** Over 20,000 military strength add 1 sq.foot/person over the 3 sq. foot/person standard.

References appear on following page.

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

GENERAL SPACE ALLOCATION

ARMY LIBRARIES

1. TM5-843-1. Space and planning criteria for U. S. Army service schools. 8 July 1970.

2. AR 415-50. Conterminous United States basic facilities and space allowances for construction at installations in event of emergency. August 1964.

3. AR 415-31. Basic facilities and space allowances for peacetime missions at Army installations.

4. DOD 4270.1M. Construction criteria manual.

5. AR 415-36. Peacetime construction in overseas areas garrisoned on a temporary basis. 10 February 1955.

6. Tri-Service Committee. Proposed revision to criteria. Mimeographed. Department of Defense, n.d.

SUMMARY A

Throughout this section we have attempted to show how similar the planning and design problems are for Army, other military, and other Federal libraries as well as between Army technical libraries and post and camp libraries. We have also indicated these problems are very similar to those faced in planning and designing civilian libraries of all types. Because of these similarities it is our belief that there is a fundamental base (generic) to the planning of all libraries. It is only as one moves through the design process, choosing to emphasize aspects, that differences begin to appear; and most of the differences lie in the content and extent of the data housed in the facility rather than in the facility itself. All libraries require space for patrons, resources, and staff; each library will choose some element from each area; the combinations are almost infinite but the base is finite.

As can be observed, there is very little data available relating specifically to Army technical libraries. Because of this and the fact that different types of libraries have more common than unique aspects, it is appropriate and necessary to examine all types of library facilities in order to develop sound data for Army technical libraries in the future. It may be felt that a broad approach is unnecessary and wasteful. Such a view would seem to be somewhat short-sighted, as it assumes each type of library is so unique as to have nothing to offer to other types. This assumption must be examined before it is accepted. Also, library services are changing and what is a given today may not exist tomorrow. To confine the exploration of physical facility requirements to Army technical libraries, and to try to create a flexible, long-term planning and design process for that base, would seem to be less than good practice.

By expanding the examination of existing practice to all types of facilities, the chances of eventually developing a very useful process are improved. At the same time many other types of libraries may benefit from the work and, as will be discussed in the chapter on implications, perhaps an improved process may be developed that will be of value to all libraries.

Over all, the process of securing Army technical library physical facilities leaves much to be desired. There is little organization to the process, the design process is limited in scope, evaluation is almost non-existent, the implementation procedures are complex, and chances of success extremely limited. In Section D of this report are recommendations for improving current practices, but these recommendations do not explore the question of improving the chances of securing funding. Such a study is in the province of the military and management fields; it is not part of the design process, although it is critical to whether or not there will be a design process.

On the basis of our examination of the design process for Army technical libraries, we draw the following conclusions, listed under the headings employed in the main body of the report:

GOALS

1) Published definitions of functions, purposes and roles of Army technical libraries are insufficient for generating an effective written building program.

2) The project librarian should clarify the library mission goals in the context of broader military goals prior to evolving the building program.

3) This should involve the clear identification of the total user community and other parameters, including cost and time targets.

INTERPRETATION

1) The complexity of design problems in terms of use, costs, technologies, and administrative procedures, requires the creation of multi-disciplinary teams operating within the strategies defined in the goals.

2) Because of the long duration of the present building cycle, changing personnel, and possible ambiguities, a written building program is an absolute necessity.

3) A technique needs to be established which insures that all design options will be considered (within the context of the allocated space).

4) The design criteria should develop from an analysis of the activities to be accommodated, rather than from standardized solutions.

IMPLEMENTATION

1) Development of co-ordinated decision making procedures, from project inception to post occupancy evaluation, is necessary to achieve adequate facilities reflective of all needs.

2) There must be a better understanding of the implications of administrative, professional, capital, operating and maintenance costs on building life costs.

3) Implementation procedures need to be simplified and directed at achieving quicker design and construction times.

EVALUATION

1) No effective, objective evaluation procedures exist.

2) Because of the lack of such procedures, there is no way to determine if a satisfactory facility has been created. Subjective evaluations of the facility tend to be indeterminate as to the success or failure of the project.

DATA COLLECTION

1) No adequate data base for planning Army technical libraries presently exists.

Recommendations for Phase II

There is a need to create a program to develop solutions for problems in design and construction of Army technical libraries. The program should include the following problem areas.

1) Develop a comprehensive listing of library activities and their interrelationships.

2) Develop appropriate ranges of performance criteria for Army technical library facilities.

3) Develop methods for generating alternative environmental design solutions.

4) Develop management and cost control techniques for use in the design and construction process.

5) Develop procedures to insure adequate objective evaluations.

SECTION B

STATE OF THE ART:

PHYSICAL FACILITIES FOR LIBRARIES IN GENERAL

INTRODUCTION B

The Army technical library was the focus of the discussion in Section A of this report. Its role was defined, and operations, needs and problems as regards physical facilities, were analyzed. As noted in the Summary to Section A, we have concluded that a) data relating specifically to Army technical libraries was too incomplete to be used as a basis for planning; b) the planning and design problems encountered by Army technical libraries are very similar to those faced by other Federal and civilian libraries. We have therefore investigated the state of the art in physical facilities for other types of libraries.

Section B contains the results of this investigation: a report on current practice in providing physical facilities for non-Army libraries. This information is applied to the case of Army technical libraries and will help provide some of the documentation needed to support requests for facilities.

The basic goals of a library are briefly discussed in Part B.I. This discussion of goals is expanded into a narration in Appendix 1 to more clearly explain what libraries are trying to accomplish for the benefit of architects and others who have never been involved with planning libraries. A comparison of these goals with the goals of Army technical libraries (as described in Part A.I.) shows the similarities.

The remainder of this section describes library planning methods currently in use, current practice in library facility evaluation, and the standards now in use for determining space allocations, lighting levels, and other important design values. Throughout Section B wherever the term "building" is used, as in the phrase "building committee", it should be interpreted as meaning either a separate library building or a space allocated for the library within another structure.

GOALS B.I

WHAT IS A LIBRARY?

The purpose of a library is simple. It provides information. The organization and activities within a library, however, are not as simple as the primary aim. In fulfilling this purpose a library must select, acquire, organize, prepare, preserve, interpret, and disseminate a vast array of materials in many forms.

What precisely, then, is a library? What are its objectives? What are its functions? Whom does a library serve? What does the library offer in materials and in services? The answers to these questions are fundamental considerations in planning the facilities in which libraries are housed.

The objective of all libraries is to transfer information from generator to consumer. Different library types will meet this objective in different ways depending on the specific library mission, the preferences of the clientele, the nature of the information. Basically, however, the library functions performed in accomplishing this information transfer are generic.* A consideration of these basic functions and the activities involved in their fulfillment is critical to the development of adequate library environmental designs.

The users of the information, the particular group served by a particular library, will also affect the nature of the facility. Users present themselves to libraries in a variety of types and numbers with a range of needs. Some are experienced users and require only physical and bibliographical access to material; others are new users who need interpretation of the library resources. The materials and services offered by a library should reflect the needs of the users. Different library types have responded to these needs by developing in different directions, emphasizing special services and providing specific materials. These emphases will frequently have an impact on the arrangement of library space.

Time also affects library facilities, for it is over time that changes occur in user groups, information packaging, and service possibilities. Allowing for a dynamic change factor requires a flexibility in space requirements which ideally would be a "built-in" feature of the facility.

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* See Section C for a detailed explanation of library functions.

INTERPRETATION B.II

HOW HAVE LIBRARIES BEEN DESIGNED?

The purpose of this part of the report is to describe the present state of the art of library design. Overall it has several important implications for planning new facilities for Army technical libraries, especially in the planning team concept. A brief historical overview of the planning process is presented along with a discussion of current design methods, a description of the planning team concept and members of the team and a consideration of the problems involved in the preparation of the building program. A case study illustrates typical decision points.

Historical Background

It should be recognized that the design of libraries is a broad cultural endeavor, frequently summoning up the best in architectural design and library science, and extending far back in time. Libraries have evolved gradually over time as the art of printing and publishing developed and as new information media have become available. The earliest libraries for codex manuscripts were found in medieval monasteries beginning in the 9th century. By the 13th and 14th centuries when college libraries were introduced, such as the Sorbonne in Paris or at Oxford and Cambridge in England, the form of the medieval library was well established: a long narrow room with windows down either long side and books arranged on low sets of shelves, their tops raised into desks. The books were chained to the shelves, which were set at right angles to the walls with an aisle down the center. This plan was functionally so satisfactory that the only changes made by the Renaissance were in terms of architectural style. Michelangelo's design for the Laurentian Library of 1524 is basically of this type although the invention of the printing press in the previous century had increased the supply of books and consequently the size and number of libraries.

The first fundamental change to the form of libraries occurred during the latter half of the 16th century. The Baroque libraries of Spain, Italy, Austria, and Bavaria, located in palaces and monasteries, became much larger, higher, vaulted rooms, magnificently decorated and lit. The aisles disappeared and the books were now contained in high shelves against the walls. As more and more books had to be accommodated, the walls grew higher and higher and balconies and galleries were introduced to reach the upper tiers. By the end of the 18th century library book collections had grown to unprecedented size. Göttingen

University library grew in five years from 12,000 volumes to 110,000 by 1786. The French Revolutionary architect Boullee proposed a triple-tiered library of vast proportions to meet this new need. But clearly a new principle for housing the mass reading requirements of the industrial revolution was necessary. This was accomplished in a series of national public libraries constructed in Paris and London in the 19th century. The Bibliotheque Nationale designed by Henri Labrouste in 1868, and the new Reading Room of the British Museum of 1854, designed by Panizzi, the librarian, separated the reading rooms from the stacks and offices, establishing the tripartite division which has characterized large public libraries since that time. To quote architectural historian Nikolaus Pevsner,

> "With that, modern conditions are reached. For well over fifty years nothing essential changed except size, and when it comes to the one change which distinguishes today's library planning from Panizzi's or that of the Bibliotheque Nationale. . . that is the change from the monumental to the unmonumental reading room. . ." (14)

The library, just as the book it houses, has an ancient lineage. Changes in its design have occurred gradually. Up until the present time the design of libraries seems to have followed the more or less traditional pattern of architectural practice with very few innovations. The differences between libraries have been a matter of degree, not of kind. The future, with the increased use of taped and minaturized information media, new services, new use patterns, may someday create radical departures from traditional library design.

Alternatives for a New Facility

There are a number of alternatives open to the librarian or administrator faced with creating a new library facility; a choice must be made before a program can be written.

a) If existing space has been outgrown, remodel the present facility to accommodate more books more efficiently by such devices as adopting the 'compactus' storage system or reducing bulky journals or periodicals to a microformat.

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(14) Pevsner, Nikolaus. Nutrimentum Spiritus. In: Architectural Review, 130:10 (October 1961) p. 244.

b) Expand into an adjoining space or building by adopting it to library use.

c) Build an addition to the present facility either horizontally or vertically.

d) Move the library into an existing space or building which provides the required square footage.

e) Lease space in a newly-constructed commercial building on a long term lease basis and adapt it to library use.

f) Build a new library building.

Adapting the recommendations of the Library Administration Division of the American Library Association in its guide to remodeling (15) we arrive at the following considerations in attempting to decide which course to follow:

1. Has the shift in activity in the user area rendered the present site unsuitable? (See criteria for determining location of library on p. 80).

2. Remodeling costs can often equal (or even exceed) the cost of new construction and should be carefully weighed against convenience gained.

3. Will the structural strength of the existing building permit doubling or trebling stack storage capacity, while still maintaining a safe floor loading situation?

4. Older buildings may not permit needed additions to existing plumbing and electrical system required by expansion.

5. Non-availability of a proper site at the most desired location can be a factor in deciding to remain in an existing building. Demolition costs can often be so high as to warrant occupying, or continuing to occupy, an existing building.

6. In the case of an addition to an older building, the resulting facility may be more costly to service than a completely new one, e.g., the older structure might require a second entrance, thereby raising the control costs.

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(15) American Library Association, Library Administration Division. Library facilities: an introductory guide to their planning and remodeling. A.L.A., Chicago, n.d., 6 p.

7. Attempts to reconcile floor levels in the new structure with existing floors may be awkward and result in either irregular floor levels or extremely high and expensive ceilings in the new addition.

8. Attempting to either match or complement the architectural style of an older building can prove both expensive and difficult.

9. With regard to leasing, the A.L.A. guide notes the following:

   > "Some public libraries have solved their library building problems by arranging with private enterprises to erect a structure specifically designed for library purposes. Most of the buildings can be converted to commercial use if it becomes necessary. Under these circumstances, the library takes a long term lease which specifies that the owner is responsible for the exterior of the building and that the library is responsible for maintenance of the interior." (16)

Other authors also describe how to identify, select, and evaluate alternatives. In an article in Minnesota Libraries (December 1965) Frederick Wezeman tells how surplus Post Office buildings have been remodeled into public libraries. (17) Of a total of 21 buildings ranging from 30-60 years old, 6 were slightly remodeled, 15 extensively. In 13 instances an architect's services were sought. Remodeling costs ranged from $1.00 to $20.00 a square foot. Based on the results of a survey of such remodeled libraries the author makes the following recommendations:

1. When deciding whether to remodel or not, consider carefully:

   a) location of building

   b) whether adequate parking can be provided

2. In attempting to upgrade the interior environment of the remodelled building consider such factors as:

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(16) American Library Association, Library Administration Division. Library facilities: an introductory guide to their planning and remodeling. A.L.A., Chicago, n.d., p. 3.

(17) Wezeman, Frederick. Post office buildings for public libraries. In: Minnesota Libraries, 21:8 (December 1965) p. 219-21.

a) construction (or improvement) of a mezzanine to provide two story open areas

b) carpeting

c) suspended ceilings

d) improved lighting system

He listed some of the disadvantages of remodeling: lack of flexibility in the remodeled building because of irremoveable load-bearing walls, often poor vertical transportation, other defects too hard to correct. The usual advantages are: an advantageous site, and good public relations because they think they are getting something for nothing. He advises that, if remodeling costs are beginning to equal or exceed 60% of the cost of a new construction, this would indicate that a new building would be a better and a more economical solution. Another rule of thumb advises that if a building project requires 50% of its cost to upgrade the existing facilities rather than provide new spaces, the project is not feasible.

Architect William Ensign, in his talk at the 1968 AASA Convention in Atlantic City (18), listed the following considerations on the remodeling of schools which might equally well apply to libraries:

1. Community feeling
2. Land acquisition costs
3. Location of site
4. Density of served population

He strongly advises establishing a firm commitment to an educational (library) policy first in order to have something against which to evaluate the new planning rather than the reverse order, which would amount to little more than expediency with consequent deterioration of library quality. Some of the inadequacies that one may encounter in remodeling as listed by Ensign include safety hazards, obsolete plumbing, out-dated mechanical equipment, insufficient lighting, poor sound control, and poor circulation.

Ensign also reported on a formula developed for determining the feasibility of a renewal project (here adapted to library use), which might be useful in determining whether to remodel or not:

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(18) Renovate and modernize or abandon and build. Summary of an illustrated talk by William L. Ensign of McLeod, Ferrara and Ensign, Architects, at the AASA Convention, Atlantic City, March 1968, 4p. (ED 018 102).

If $\frac{Cl + Ch + Cs}{(Lm)\ (La)} < \frac{R}{Lr}$, then remodeling is feasible where:

Cl = cost of improvements for library usage

Ch = cost of improvements for purposes of health

Cs = cost of safety improvements

Lm = estimated useful life of remodeled library

La = estimated index of library adequacy (0-1)

R = replacement cost of new library

Lr = estimated life of replacement library

A case study of the events and decisions associated with building the University Research Library on the UCLA campus is reported on page101 as an example that also points out the need to select and defend sound solutions.

Where to Locate the New Library Facility. Location of the new facility is of paramount importance. The principles for this decision are essentially the same whether the new library is to be part of an existing (or new) building, or whether it is intended to build an independent library building. It must be as close and convenient to its intended users as possible. The changes which may occur over time to a population served, as it grows or relocates, must be taken into consideration. As described in the case study at the end of Part B.II, movement of the Humanities and Social Science faculty northward on the UCLA campus away from the traditional center, due to crowding, was probably the deciding factor in locating the new University Research Library on its present site.

The American Library Association (19) lists the following considerations with regard to siting the new facility:

1) Geographic Factors:

    a) For public library branches, direction and growth of the community.

    b) For academic libraries, future expansion of campus.

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(19) American Library Association, Library Administration Division. Library facilities: an introductory guide to their planning and remodeling. A.L.A., Chicago, n.d., p. 1.

2) Demographic: projected rate of growth (over at least a 20 year period) of the community or school.

3) Composition of population served:

    a) For public libraries, cultural and educational structure of community.

    b) For academic libraries, percentage of graduates versus undergraduates, size of faculty and their special interests.

Michael Brawne (20) characterizes small public libraries as operating like supermarkets. Users serve themselves, consequently ease of access to materials is important. Army technical libraries serve fairly large numbers of people and the staffing complement is not large enough to help everyone. Therefore, self service is a necessity in this type of library. Like supermarkets (or successful bookstores), libraries should be located in the midst of pedestrian flow. It is only natural for the busy scientist or researcher in an Army situation to make more effective use of services if he passes the technical library several times a day than if he must make a special trip to an out of the way library.

This principle is to be applied to Army post and camp libraries, which are almost exact counterparts in their military communities to the branch public library in a civilian community. Army Technical Manual TM 5-803-6 entitled Site Planning of Community Centers provides some sound standard planning for shopping center grouping of such facilities as the bank, cafeteria, post exchanges, post office, and commissary around a variety of different mall shapes, supported by parking. "Because of their related use the library and education center should be located adjacent to each other; however, they should also be convenient to troop housing area." (21) The education complex is also to be located near the shopping center complex, thus placing the library near the hub of traffic flow. Unfortunately the Army standard plans for post and camp library buildings, drawings DEF 29-04-24, -25, and -26, have an internal arrangement with a narrow vestibule at the entrance hemmed in by toilets on the one hand and a music room on the other that makes it impossible to have an inviting display of books to anyone outside the building. Newer dynamic planning, such as the libraries at Fort Campbell (the entire library) and Fort Ord (the exterior) could improve the situation.

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(20) Brawne, Michael. Libraries, architecture and equipment. Praeger, New York, 1970.

(21) TM 5-803-6. Installations planning. Site planning of community centers. p. 9.

Determining functional relationships. The librarian and the architect must share a common understanding of the roles and functions of the library under consideration. Only then can the alternatives be carefully weighed and decisions, such as location, made in a defensible manner. Thus a key element in the design process is a careful description and analysis of the library functions. Since the overall functions of libraries seem to be generic, this discussion is also of value in planning and designing Army technical libraries.

In order to plan any library it is first necessary to understand the organic relationship of its working parts or components to each other. It has been said that at least three important processes are taking place simultaneously in any functioning library.* In order to ensure the smooth flow of those processes, the library designer must receive a clear picture of what they are and how they are related from the librarian. There is first of all a flow of materials; that is, the books, periodicals, microtexts, tapes, etc., that are the stock in trade of the library. In order to get onto the shelves where they become available to the users, the flow of library materials in a particular library might be diagramed in a sequence similar to the simplified diagram on page 83 .

At the same time there is a flow of information (e.g., requests for purchase, internal staff communication, library material orders, updating of the card catalog, accession lists, etc.). This flow in the same library might be illustrated by the diagram on page 84.

Finally there is the movement of the library users (not the staff, whose movements are best indicated by the first two diagrams). The possible path for library users in this same library might be diagramed as shown on page 85.

Combining all three flows into a single diagram, we have the simplified model of this particular library's operations on page 86.

Diagrams of this sort will differ from library to library, of course, but many of the relationships of parts will tend to remain constant. Certain common characteristics of library operations are immediately revealed by such diagrams. For instance, important adjacencies and sequences of activities become apparent, such as the proximity of circulation desk, card catalog, and reference area or the sequence of acquisition, cataloging, and processing. It is also clear from the diagrams that staff work areas are largely separate and distinct from reader-user areas of activity

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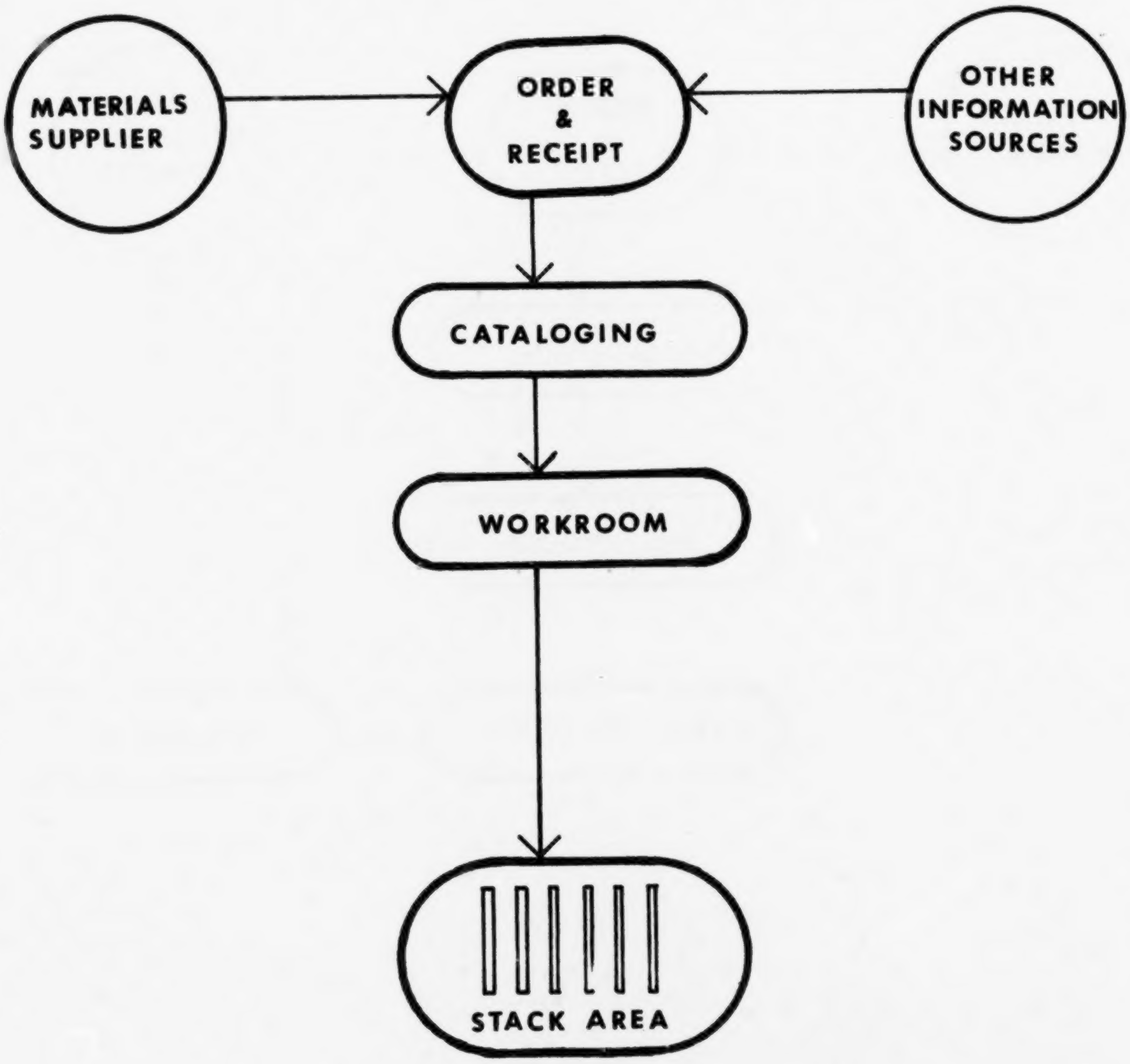
* See Libraries, architecture and equipment, by Michael Brawne. Praeger, New York, 1970.

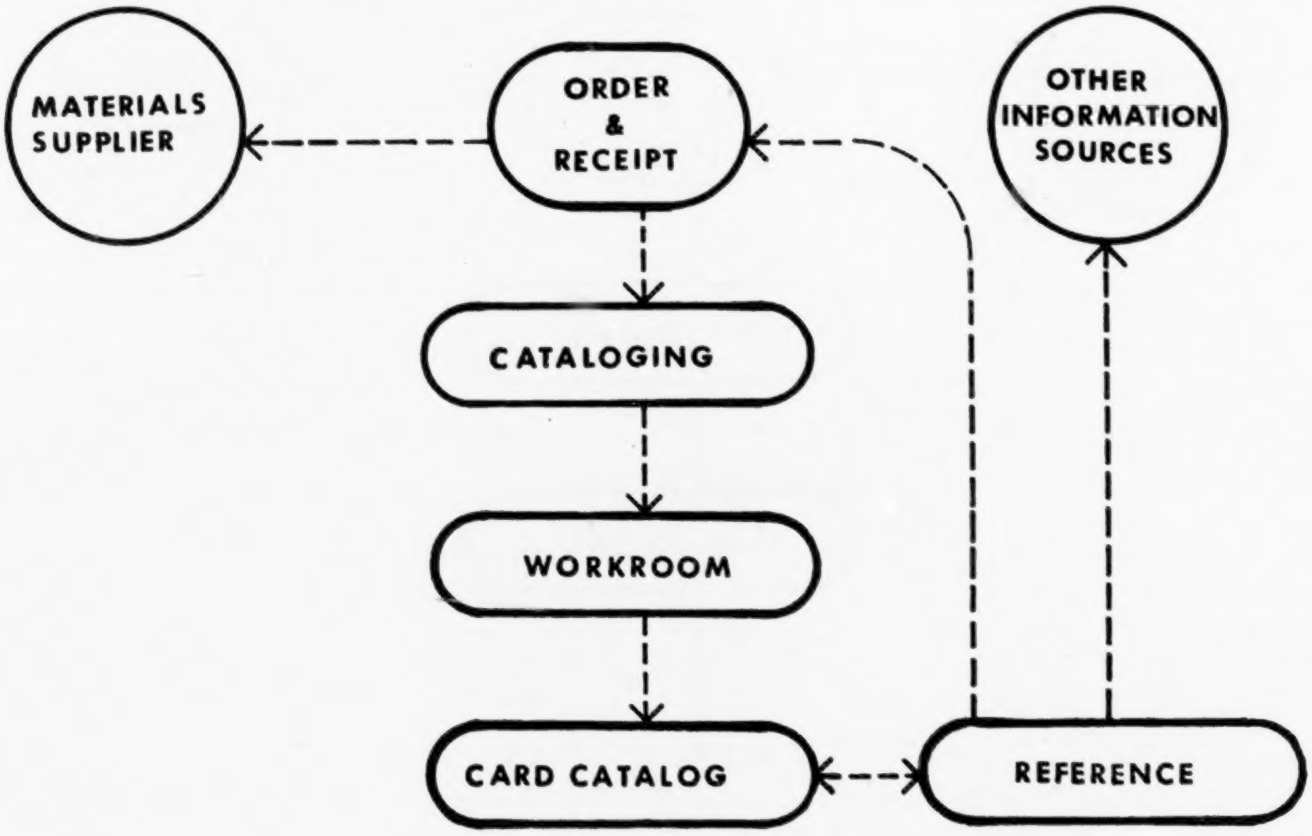
ANALYSIS OF LIBRARY FUNCTIONS

FLOW OF LIBRARY MATERIALS


MATERIALS SUPPLIER
ORDER & RECEIPT
OTHER INFORMATION SOURCES
CATALOGING
WORKROOM
STACK AREA

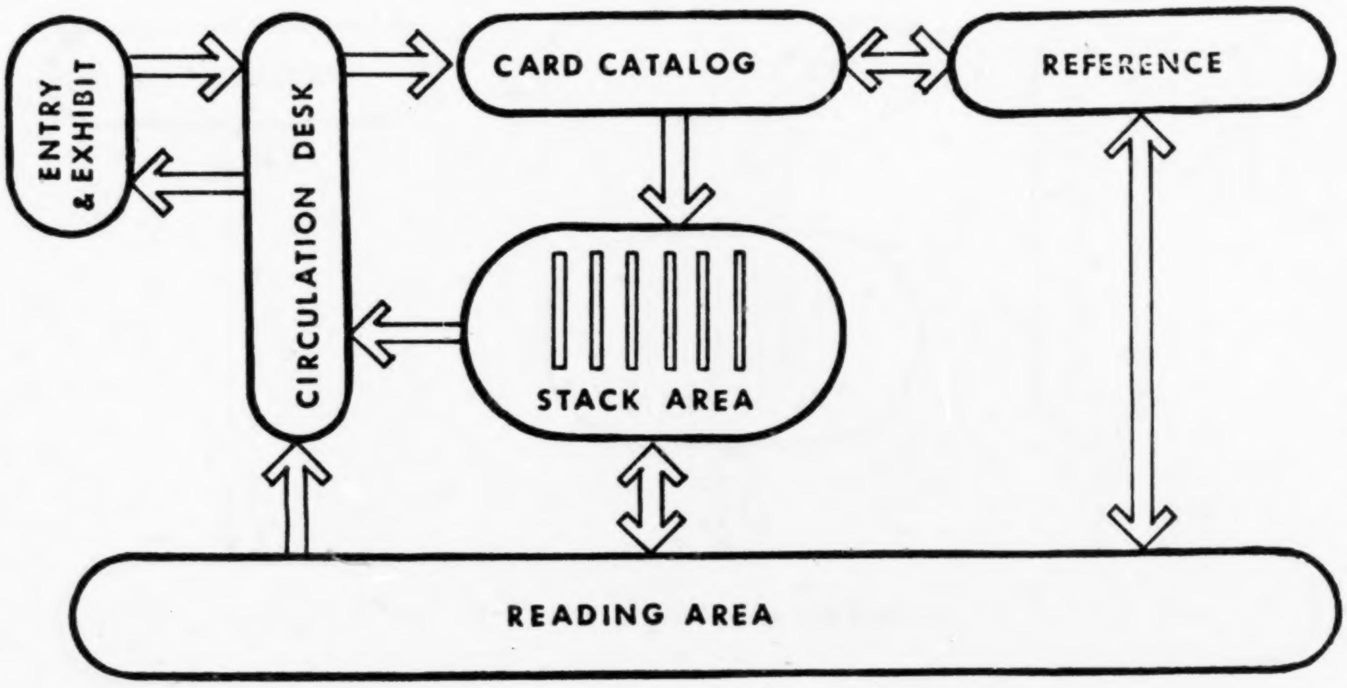
ANALYSIS OF LIBRARY FUNCTIONS

FLOW OF INFORMATION


MATERIALS SUPPLIER
ORDER & RECEIPT
OTHER INFORMATION SOURCES
CATALOGING
WORKROOM
CARD CATALOG
REFERENCE

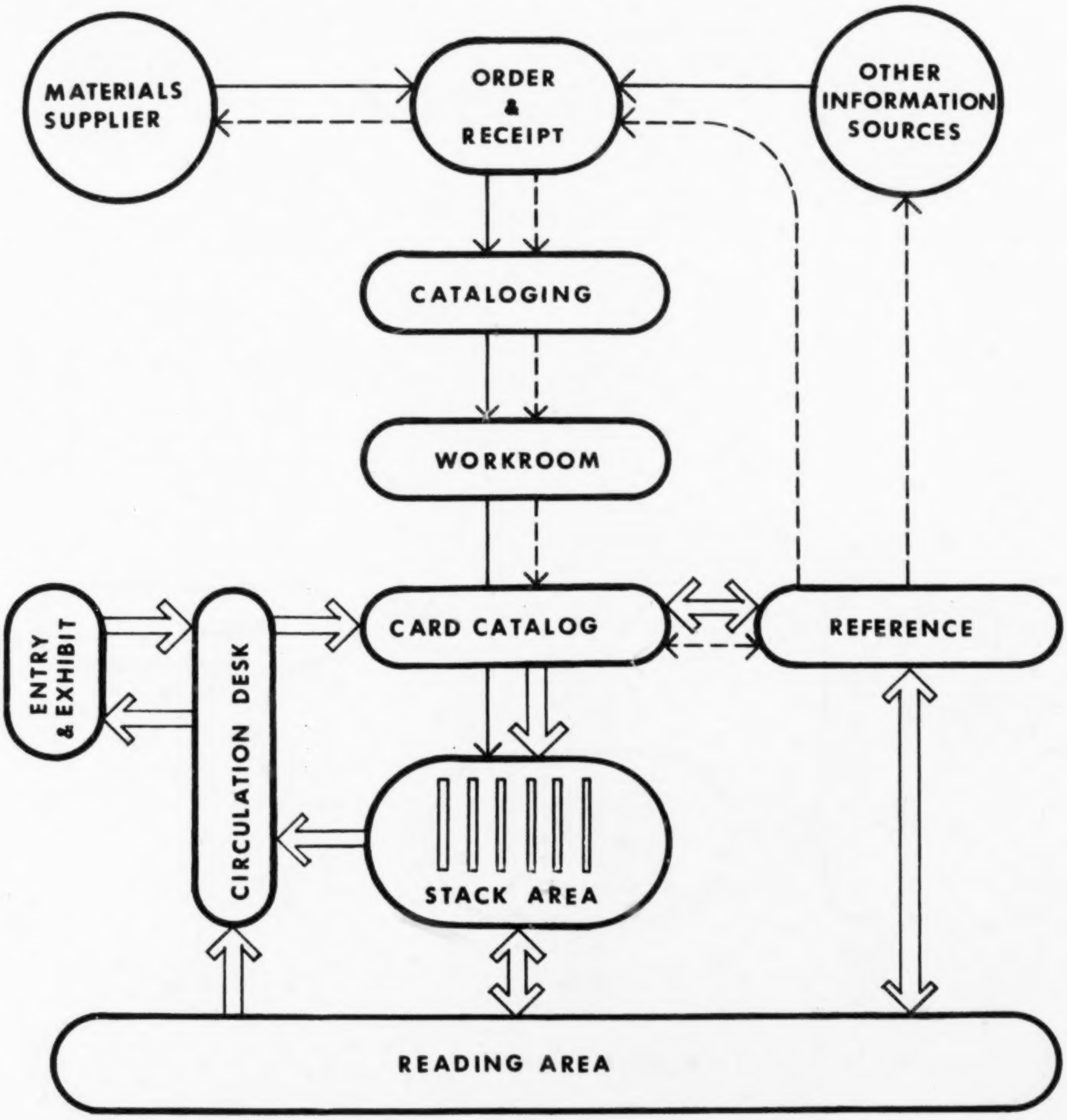
ANALYSIS OF LIBRARY FUNCTIONS

FLOW OF USERS


ENTRY & EXHIBIT
CIRCULATION DESK
CARD CATALOG
REFERENCE
STACK AREA
READING AREA

ANALYSIS OF LIBRARY FUNCTIONS

COMBINED FLOWS


MATERIALS SUPPLIER
ORDER & RECEIPT
OTHER INFORMATION SOURCES
CATALOGING
WORKROOM
ENTRY & EXHIBIT
CIRCULATION DESK
CARD CATALOG
REFERENCE
STACK AREA
READING AREA

(the former occupying the top half of the combined flow diagram, the latter the bottom half), with contact occurring at two key points, the reference area and the circulation desk. Within each of these areas there is a close, organic interrelationship of parts. It is also apparent that the card catalog (or its equivalent) is usually central to the whole operation and probably belongs somewhere close to the center of gravity of the library, and that the circulation desk is best located near the entrance/exit.

In order to ensure a smoothly operating library the designer should be careful to respect these adjacencies and create as few conflicts and disturbances as possible by crossing circulation paths as infrequently as he can. A very useful device for communicating desired adjacencies to the architect is to have the librarian fill out a proximity chart for his library. The figure on page 88 is an illustration of such a chart for a small academic library. This particular one uses a four-value rating system: "Essential", "Desirable", "Unimportant" and "Undesirable". For greater exactitude, five and six-value ratings can be used.

In order for the architect to understand just what room will be required in the plan for each complex set of activities within the library a diagram such as the one illustrated on page 89 giving accurate anthropometric dimensions should be prepared by the library staff with the assistance of the architects. Colin St. John Wilson, quoted elsewhere in this section, found it more useful to ask the staff of the British Museum Library to measure the extent of each functional activity than ask for a bulk square footage estimate.

After space standards are compiled many architects find it highly advisable to display to the client-user team a graphic inventory of total building space as it has been assigned to each use (i.e., circulation, storage, staff, readers, etc.) in some easily visualized unmistakable form such as shown in the diagram on page 90 . Since the proportionate allocation of space is a fairly accurate reflection of how the client's money is being spent, this is a good time to confront him with the cumulative program. If the client is dissatisfied, it is easier to reassess and reallocate priorities at this point than at later stages in the design.

When agreement is reached on the inventory of spaces, one of the most creative and exciting steps can take place in the programming process, involving client and architect in the functional interrelating of these spaces. Using cut-outs of each of the spaces in the inventory, color-coded according to function for easy identification, the client is asked by the architect to rearrange the pieces until he has achieved the arrangement with the best possible set of spatial interrelationships such as in the diagram on page 91 . Although the bulk of the relationships will be horizontal, in the case of buildings of two stories or more, it will be necessary to find cleavage points in the pattern at

ANALYSIS OF LIBRARY FUNCTIONS

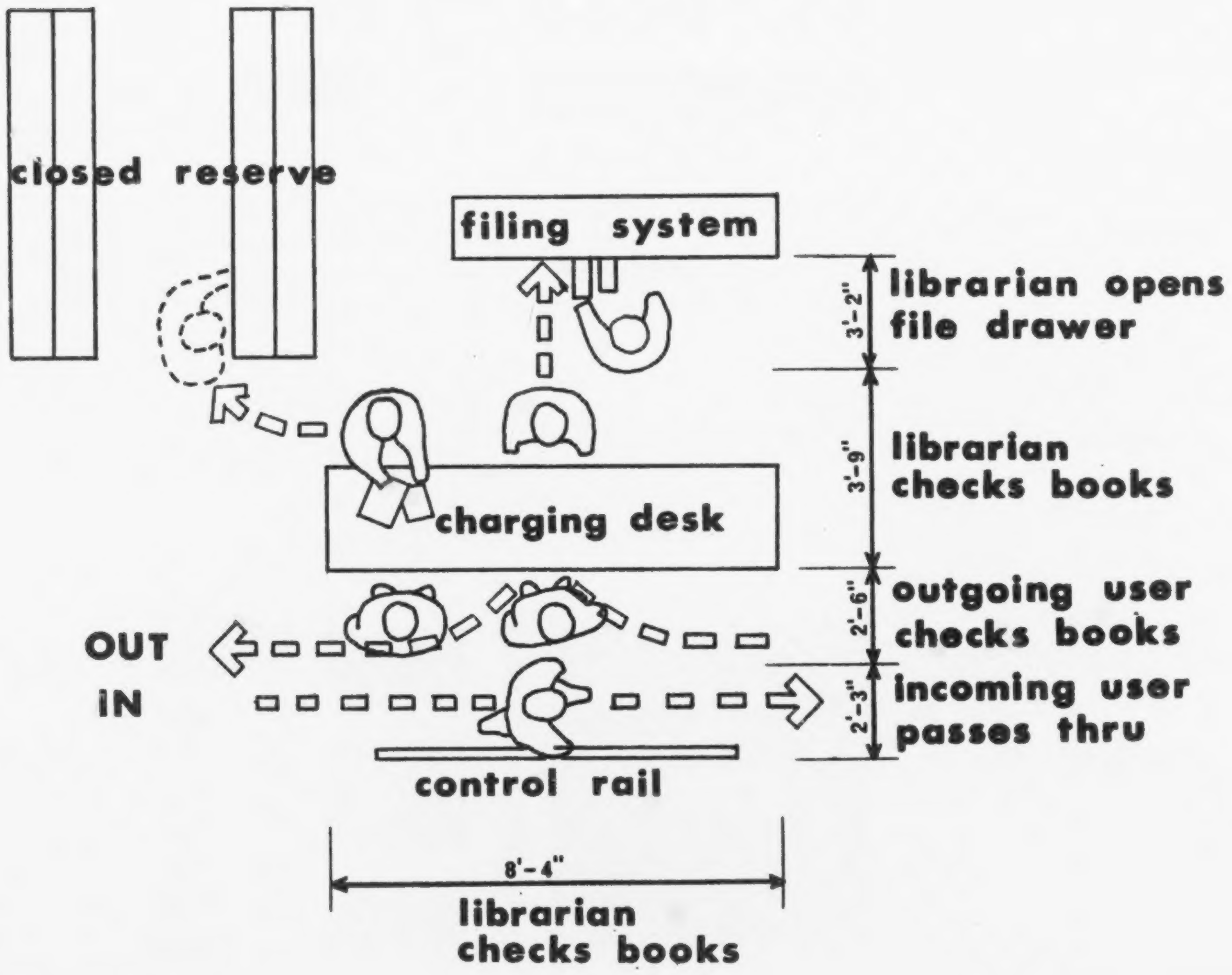
PROXIMITY CHART

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ENTRY/EXIT 1		○		□	□													X		○
EXHIBIT 2																				
READING AREA 3								○	○	○										
CIRCULATION DESK 4						□			X	X										
MEETING ROOMS 5																				□
CARD CATALOG 6								○						○		○				
REFERENCE AREA 7									□								○			
STACK AREA 8									□	□					○					
READING AREAS 9															X					□
CARRELLS 10															X					
LIBRARIAN'S OFFICE 11													○		X					
WORK ROOM 12														○		○		○		
STAFF ROOM 13																				○
ACQUISITIONS DEPT. 14																○	□	○		
COPY MACHINE 15																				
CATALOGING DEPT. 16																				
INTER LIBRARY LOAN 17																		○		
RECEIVING ROOM 18																			○	
MAINTENANCE 19																				
WC 20																				

□	**proximity essential**
○	**proximity desirable**
	proximity unimportant
X	**proximity undesirable**

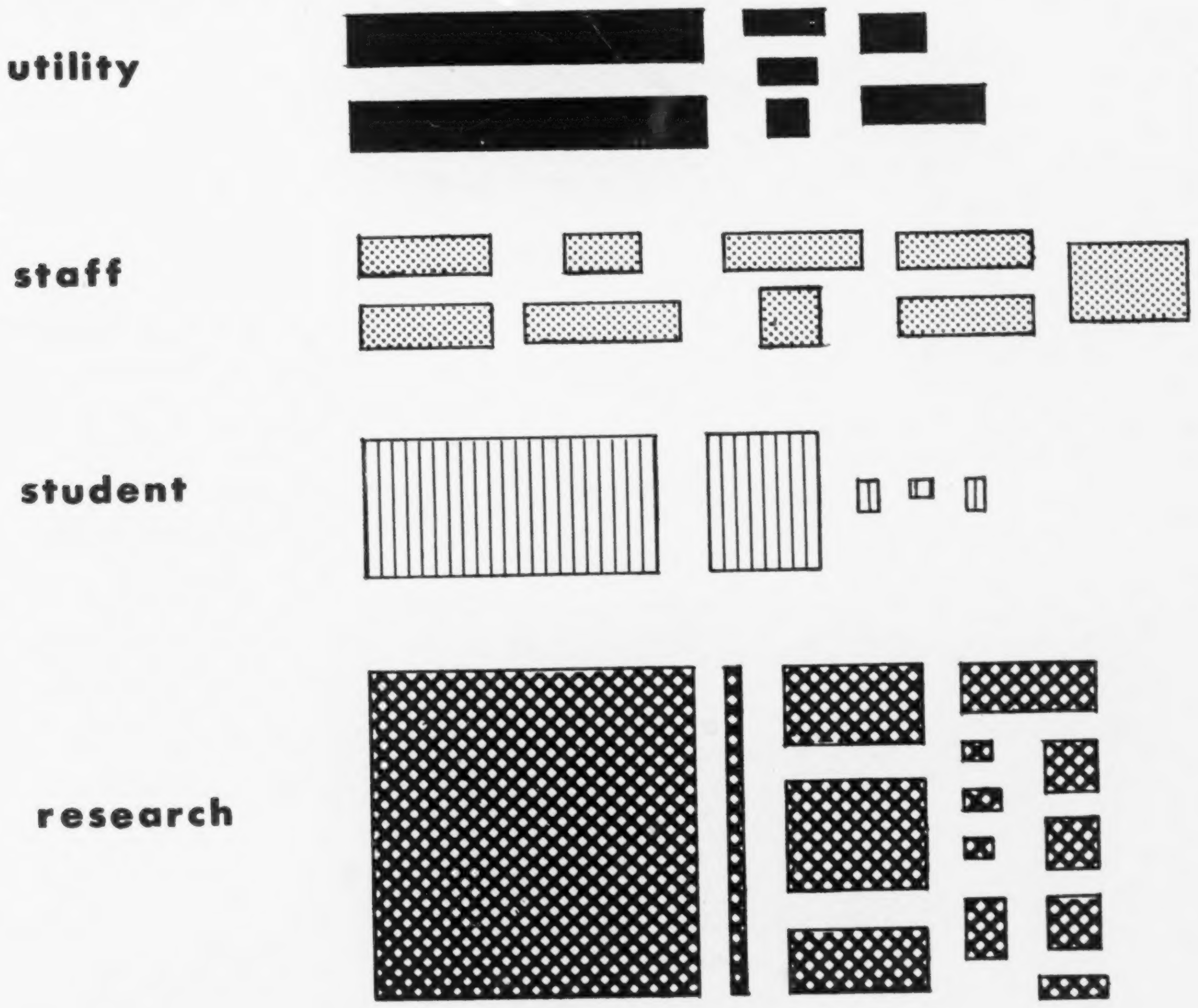
ANALYSIS OF LIBRARY FUNCTIONS

HYPOTHETICAL CIRCULATION AREA


closed reserve
filing system
charging desk
OUT
IN
control rail
3'-2"
librarian opens file drawer
3'-9"
librarian checks books
2'-6"
outgoing user checks books
2'-3"
incoming user passes thru
8'-4"
librarian checks books

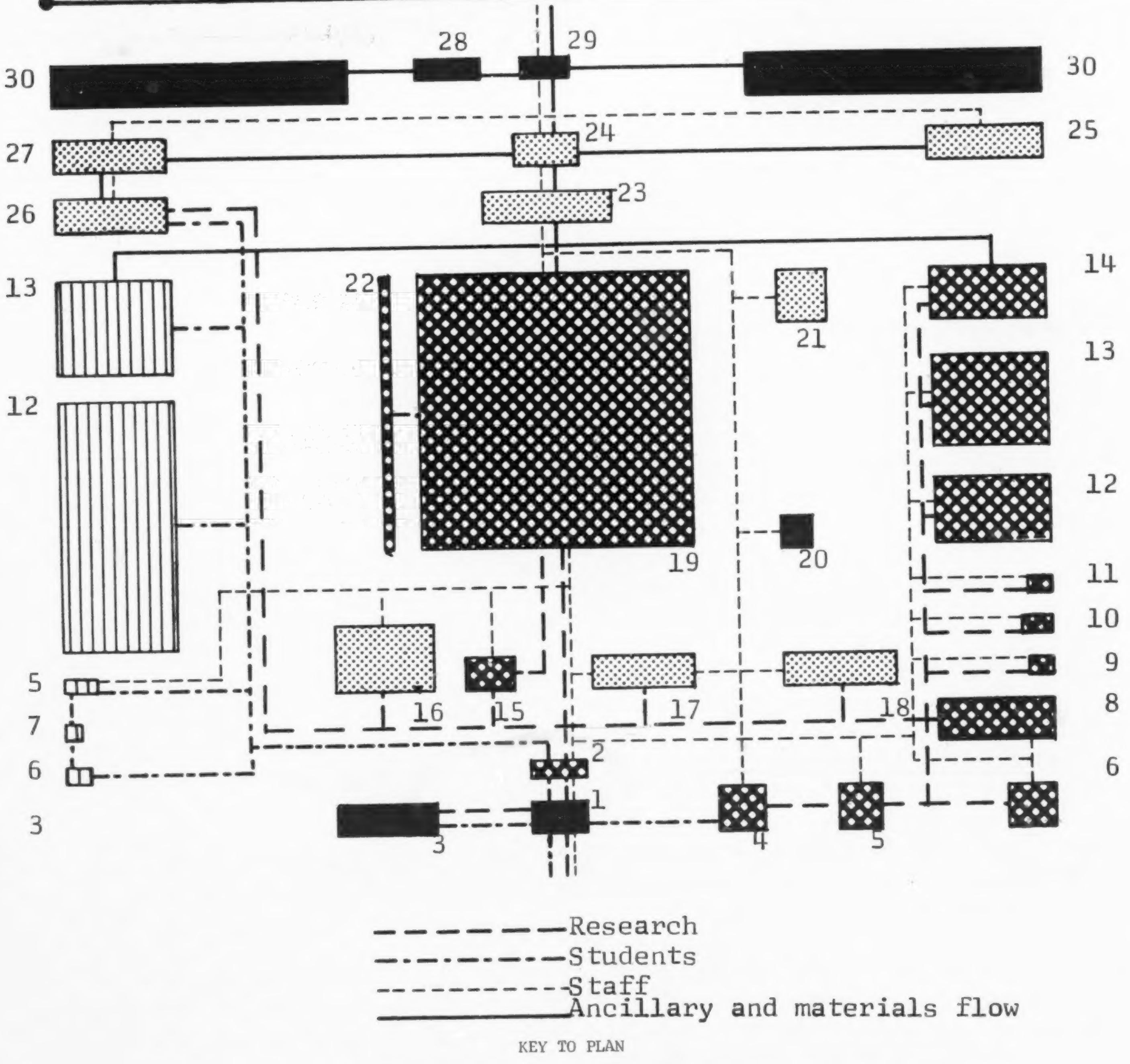
ANALYSIS OF LIBRARY FUNCTIONS

INVENTORY OF SPACES


utility
staff
student
research

ANALYSIS OF LIBRARY FUNCTIONS

SPATIAL INTERRELATING


28
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16
15
17
18
9
8
7
2
6
6
3
1
3
4
5
Research
Students
Staff
Ancillary and materials flow

KEY TO PLAN

1. Lobby and exhibitions
2. Circulation desk
3. Check room and toilets
4. Public catalogues
5. Reference service
6. Periodicals
7. Catalogue
8. Bibliography
9. Pamphlets
10. Maps
11. Microfilm and microcard
12. Reading room
13. Open stacks
14. Study rooms
15. Rare books
16. Reservation-information service
17. Administration
18. Conference room
19. Limited access stacks
20. W.C.
21. Staff lounge
22. Carrels
23. Catalogue department
24. Acquisitions department
25. Printing and binding
26. Photo-duplication service
27. Special library association
28. Maintenance
29. Shipping and receiving
30. Mechanical equipment

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which separation by floor can occur. This is a time consuming process of trial and error requiring patience and perservance but, when achieved, it essentially establishes the spatial program for the new library which can then be translated almost directly into building plans. Caudill Rowlett Scott, who use this technique, call it "gaming", a term which vividly portrays the degree of involvement and participation the process evokes.

These procedures have been used successfully and we recommend that they be employed as an interim system until a fully integrated process can be developed. Local variations can and should be employed in order to create a facility reflective of the local needs. Such requirements usually are generated by the planning process.

Planning the New Facility

The decision to authorize the construction of a new library facility is usually made at a high executive level within an organization. This could be a college president, Army Post Commandant, or municipal library authority. The ultimate decision is often made in response to a feasibility study undertaken by the campus planning office, post engineer, or city planning agency.

As soon as the decision to go ahead is made, further detailed studies must be undertaken to determine the character, size and location of the library. The machinery for undertaking this study and controlling its results should be instituted by the initiating body from the very beginning. For the best results this process should be carefully thought through and established. There are two most important factors: (a) ample time must be allowed for the process to unfold to ensure that the widest range of alternative possibilities is reviewed and the best possible choice is made; and (b) an appropriately broad selection of experts should be invited to take part in the study, giving each an opportunity to exercise his expertise.

It should be repeated at this point that the design of a library is one of the very broadest cultural endeavors, and that it involves questions of public taste, civic pride, urban design, engineering and technical skill, understanding of human behavior and motivation, information science, and the design of interior space including lighting, mood, acoustics and furniture. Care, therefore, should be taken in selecting the individuals who will plan the library, and time should be allowed for each one to perform well and to interact properly with the other members.

All of the factors discussed above must be considered when developing a plan for a new Army technical library. As discussed in Section A, the problems involved in adapting a library to a predetermined space require the best professional expertise available. Throughout the following discussion, the many parallels in planning for Army technical libraries and for other libraries will be apparent.

A procedure for designing satisfactory libraries has evolved into common practice and may, if carefully followed, continue to produce good libraries in the immediate future. In the longer run a more systematic method will need to be devised. Approaches could be devised along the lines of the newly emerging methodologies in highly specialized fields, such as hospital design, and in keeping with the technical advances in library and information science itself. Exploration of such new systematic methods are discussed later in this report (see Section C).

As a broad generalization, two types of decision making practices are currently employed in library facility planning. Either a library "building committee"* oversees the project, or a librarian (usually the head librarian) has this responsibility. The building committee is usually composed of individuals who have an interest in the new facility but seldom do its members have experience in planning a library facility, including the librarian who is almost always a member.

Planning library facilities is a complex task and requires the employment of a number of highly skilled individuals to develop a good facility: librarian, consultants, architects, interior designers, engineers and contractors. Building projects involve most or all of these individuals. The way in which the process is handled varies but, in general, there are two broad planning methods: independent or coordinated (planning team concept). Both methods have been used in designing libraries and both have, on occasion, produced good facilities.

Independent planning method. When the independent method is employed the individual or committee responsible for the project tends to deal with each member of the planning group in isolation. That is, a library building consultant is hired to help with the planning but he may not meet the architect, other consultants, or the interior designer. He may be hired for only a short period of time at the beginning of the project. The interior designer may not be hired until the architect has already developed the overall plan.

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* At this point it would be worthwhile to mention again that the word "building" means the space a library is to occupy and not necessarily a building used solely for library operations.

Other examples of isolation could be given; however, the main point is to emphasize that the independent approach, while widely used, does not produce the best results. Some reasonably good facilities have been designed in this way, but the chances of success are lessened simply because communication between people is difficult enough when they are face to face, let alone isolated from one another. When attempting to handle a complex planning problem without the participation of all people involved, it should not be surprising to find problems in the final product.

Planning team concept. In the ideal situation a coordinated approach is used with all of the project members working together from the start. In considering the composition of the library planning team, it should be recognized that a range of decisions has to be made affecting such diverse considerations as reader comfort and study habits, durability and serviceability of equipment, and the use of sophisticated retrieval systems. These require the services as well as the close cooperation of a group of very differing talents. Since many of the decisions are of a local nature, involving an understanding of the peculiarities of local conditions (custom, community and site), it is best to arrange that the principal members of the planning team do their work and that the decision and review processes take place in the locality where the library is to be erected. The initiator of the project, be it a post commander, the office of a college president, or a city planning board, for example, must be prepared to delegate decision making powers widely throughout the planning team, and at the appropriate levels of the planning process, in order to get the most effective use of the team. Of course, ultimate decision making powers, such as handling of funds, selection of the key members of the team, purchase of the site, and final approval of all drawings, bids and contracts must be reserved for the initiators. Great care should be exercised in putting the planning team together and selecting its various members since the success or failure of the final product may very well rest on the strength or weakness of all or any part of the design-review process.

Several architectural firms have employed the team method as standard practice. One such firm is the Houston-based firm of Caudill Rowlett Scott. William W. Caudill, a principal of the firm, expresses his own long established belief in the method in his book Architecture by Team; A New Concept for the Practice of Architecture in the following manner:

> "A team is an association of people who share common goals, who are willing to cooperate and who can communicate with each other. . . An interdisciplinary approach, involving people concerned with a wide range of specialties, results in more efficacious planning and smoother progress. An involved client who has participated on the team generally is a more satisfied client. It is the CRS policy to bring him in early and keep him with us throughout the project.
>
> Equally important is the mystique of group interaction among client and professionals, inexperienced and experienced, specialist and generalist, and the benefits of all concerned; team action brings forth in each member a new dynamic discussion of ability, of understanding, and of willingness to work toward the common goal . . . When members of the team have the opportunity to share their ideas from the very beginning, not after the fact of the preliminary design, their ideas are honed and resolved. When members of the team are involved only after the design is set, they merely hack away at the design and decimate the embryonic architectural product bit by bit . . ." (22)

Communication within the team is paramount and every effort must be made to develop effective techniques in order to achieve this goal. As William Pena suggests,

> "in the final count a successful statement of a problem for a project is no better than the ease with which the client and architect communicate their thoughts to each other. Each may have his own specialized terminology, which may become a serious language barrier." (23)

As the client's organizational structure becomes more complex there is a greater need to highly organize the framework for the dialogue. This process would be most important in planning Army technical libraries.

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(22) Caudill, William W. Architecture by team: a new concept for the practice of architecture. Van Nostrand Reinhold, New York, 1971, p. 69 and 73.

(23) Pena, William; Focke, John. Problem seeking: new directions in architectural programming. Caudill, Rowlett, Scott, Houston, 1969, p. 29.

Composition of the Planning Team

The team concept depends in large measure upon the good will of all the parties concerned. In part, good will is dependent upon a clear understanding of each individual's roles and responsibilities, thus both communication and identification are important. Major members of the planning team, whose involvement in the planning process is discussed below, are the librarian, library building consultant, architect, interior designer, and the building committee.

The Head Librarian. The first member of the planning team is, of course, the head librarian or his representative. Since he and his staff will eventually have the responsibility of operating the library, the librarian's advice must be sought right from the beginning and he should be consulted throughout the design process. He should be actively involved in generating the needs for the new library and in approving the evolving designs, as should his staff. The head librarian and his staff can bring a particular working knowledge to the design of the new building which may be extremely important for the smooth operation of the library. This is particularly true when the new library is replacing an earlier building and the library staff is thoroughly familiar with the book collection, the needs of its readers, and its customary operation. If the head librarian has been involved before in the design of new library facilities, he might be an excellent man to write the building program (the detailed written statement of what is needed in a physical facility). However, it is the rare librarian who has had this experience and it is more likely that a library consultant with extensive experience in designing libraries will be hired to aid in writing the program.

The librarian is the best man on the team to serve as coordinator for the project. He is the best person because he is the most concerned with the success of the project. If a new librarian is hired he should not be brought into the middle of a project because he should attend the process from its inception until the completion of the building. Working closely with the library building consultant, the architect and the interior designer, he helps write the program, consults on the preparation of drawings, and coordinates payments, meetings and review sessions. He advises on the selection of furniture, and plays an important role in the making of decisions relevant to the design and construction.

The Library Building Consultant. In writing the building program, the broader knowledge of a library consultant is usually needed. He is usually a librarian (although sometimes an architect) who has had wide experience in the actual planning and design of libraries. His fee may be a percentage (normally less than 1%) of the total building cost or a consulting fee. He should be hired as part of the team since he brings wide practical knowledge of library design and can help avoid costly errors. He should be retained until the project is completed. He assists the librarian in writing the building program or writes it himself, advises the architect on the development of the plans and drawings, and studies and analyzes them as they are developed. He assists the interior designer in the selection and layout of furniture and equipment.

The Architect. There is considerable debate whether it is necessary for the architectural firm to be expert in library operations and problems. Under the right conditions, a good team with an inexperienced architect can produce a good facility. A competent architect can design any space or combination of spaces provided he knows (a) what is to be done in the space; (b) who is expected to do it; and (c) what special conditions or equipment are required. The library building consultant, if employed, can be counted on to provide the necessary specialized knowledge of library design. However, there is a clear advantage if the architect has had some previous experience with libraries. It is probably advisable to select a firm with offices within 100 miles of the project site in order to render the constant service and supervision required and to be familiar with local custom, law and taste. However, if the decision is to hire an architect of national prominence, it is possible to have him associate with a local firm to ensure proper coordination with other members of the planning team and with local authorities.

Preliminary selection of the architect should follow recommendations from the local administrative, building-construction and maintenance staff; from schools of architecture and architectural journals for professional ratings; and from contractors and engineers for practical information about performance. Before a final selection is made each architect should be met and his buildings inspected. The selected architect should participate in the writing of the program since he will probably have had wide experience in program writing and be aware of certain types of information (such as user-behavior) which is essential to the program. He advises on site selection, space requirements and a preliminary budget estimate. He develops the schematic, preliminary, and working drawings and other contract documents. He advises on the bidding and letting of the contract and makes frequent inspections of the construction. He hires and coordinates the work of structural, mechanical and electrical engineers. During construction he is the owner's principal agent for the execution of the work.

The Interior Designer. The interior designer can either be hired separately by the owner or by the architect as his consultant. In either case his fee is usually a percentage of the cost of furniture and equipment. Many large architectural firms have their own interior design departments. Otherwise it is probably preferable to hire an experienced interior designer. Some library furniture and equipment is quite specialized, and familiarity with the products or design standards is, after all, the reason for hiring an interior designer. He advises on furniture, special equipment such as book lifts or signalling and communication systems, wall and floor coverings, color coordination and lighting. Again, the interior designer should be hired at the beginning of the project as a full member of the team.

The Building Committee. Occasionally there is a need to involve the community of users in the planning process since they are the individuals who ultimately determine the use of the facility. When planning a facility used by people with reasonably specific library needs and objectives, such as the clientele of an Army technical library, the use of a "building" committee may be very valuable not only for its planning input but also for the public relations value.

If a committee is formed it should be representative of all concerned groups. In addition to containing the usual high level administrators for planning and construction together with their subordinates (i.e., Vice President for Construction and the Campus Architect, in the case of a University; Senior Representative of the Post Commander and the Post Engineer in the case of the Army), and representatives of maintenance departments, the committee should also include members from the community served, such as faculty members and students for an academic library or the researchers in an Army technical library. This is a most important point which has been found to pay dividends later. Since they should be consulted at some stage in the preparation of the building program to determine their preferences, needs and habits, it is only sensible to allow them to be represented on the team. Their inclusion can ensure much wider acceptance and use of the completed library by the intended users.

Writing the Building Program

The practice and recommendations for writing a building program vary all the way from a sequential, linear process to a fully integrated team approach. The linear one step-at-a-time approach, (step 1: librarian writes program; step 2: library consultant reviews it and makes recommendations; step 3: architect receives program and designs building; step 4: interior designer develops furniture list on basis of building designed) is frequently the result of organizational funding policies wherein money can only be authorized for the next step after the completion of the preceding step. Thus, standard procedures at the University of California require that the PPG or program planning guide be fully developed by the Planning Office (presumably in consultation with the eventual using department) before an executive architect can be hired. This was most certainly the case with the University Research Library at UCLA. It also seems to be the case within the Armed Forces.

In addition it was the opinion of the majority of librarians questioned* that the program should be written by the librarian prior to the architect's involvement, and reviewed by the consultant. All were in agreement that the librarian, and not the consultant, should write it because of his greater familiarity and more precise understanding of the exact circumstances of the institution which he serves. In addition they recommended that the librarian act as coordinator of the project throughout the design process. Several of the librarians questioned emphasized the fact that frequent failures in library design resulted from poor communications between librarians and architects. At least three of the architects responding to the questionnaire* expected to receive fully-prepared programs from their clients before beginning their work.

A somewhat different point of view was expressed by other architects. Recognizing that the longer the client delayed bringing the architect into the design process, the greater would be the difficulty in communicating the client's intention to the architect (and vice-versa) they strongly recommended the formation of a smoothly-working team. Architect Karel Yasko of the General Services Administration pointed out that the Public Building Service now recommends written building programs for projects, using the design architect, when feasible, or a consultant in the preliminary planning stage of the project. Furthermore, they have recognized that separate appropriations for sites, expenses and construction funds on each project severely limit the ability of PBS to operate efficiently and recommend that PBS should press for congressional approval of a lump-sum appropriation or for a revolving fund for all future projects.

British architect Colin St. John Wilson, architect for the extension of the British Museum, is now compiling the program for the new building in consultation with the library staff. Wilson's assistant, Miss M. J. Lang, writes:

> "It became clear the easiest way to write the program was to establish a series of norms and then to note in detail the exceptions to the norms. Space and

---

* See Appendix 4 for list of librarians and architects consulted.

> furniture norms are established by the Treasury for all Civil Service employees (which includes the British Museum). That left environmental norms. Document B (Library Accomodation Standards) was the first attempt to establish environmental standards for different kinds of space. It will undoubtedly change a great deal before it is agreed.
>
> We will have something in the order of 400,000 sq. ft. of staff space in the British Museum Library. It seems clear that the only way to arrive at a convincing total even for these spaces was from an exhaustive list of individual work stations and equipment. Document C shows how we have been collecting this information. In the case of reader and stack areas we will put the information on the forms ourselves. The librarians will send us the information in the form of a text based upon the checklist set out in Document A (the rough initial checklist)." *

Whoever writes the program (and we recommend a team approach), must be certain to provide enough detail for architectural planning but not so much that the architect's freedom to design is limited.

An outline of the key elements in the program is given below:

- Objectives of institution
- Objectives of library
- Library policy and requirements
- Role of library in institutional setting
  - present and future
- Anticipated changes of institution and library
  - size/quality of users
- Description of library operation and administration
- Facilities required
  - size/quality/quantity
- Spatial relationships
  - between different services
- Special facilities
- Accommodations for readers
  - seating by type of user
  - number of seats in each reading area
  - types of seating accommodations
- Accommodations for the collection
  - present volume count in main stack collection (including monographs, periodicals, documents, etc.)

---

* Personal communication. 18 June 1971.

        - anticipated rate of growth of collection
        - shelf capacity
        - present planning period
        - special collections (reference and bibliographical, periodicals, rare books and archives, maps, pictorial material, slides, music, films and tapes)
    - Staff facilities
        - administrative offices
        - public service staff
        - processing staff
        - maintenance staff
        - rest rooms and lounge
    - Other space users
        - exhibition rooms
        - photo-reproduction rooms
        - audio-visual work
        - maintenance shops
        - meeting or assembly rooms, auditoriums
        - offices
    - Architectural/Aesthetic/Functional space

Case Study: Factors Influencing Decisions to Construct Libraries

A brief history of the events leading up to the decision to build the University Research Library at UCLA will serve as an excellent case study of the typical decision making process that may attend the growth of any library. The project was larger in scale than most Army technical libraries; however, the general pattern will be similar.

By 1950 the Powell Library, a red brick building in the Romanesque style with lofty beamed-ceiling reading rooms built in the early 1930's, was showing signs of stress due to a more rapid growth of the collection than had been anticipated. An east wing had already been added to the original building. An estimated stack capacity of 575,000 volumes had been passed; the collection had reached 600,000 volumes with projection of 825,000 by 1955 and over a million volumes by 1960. The Medical school and the Engineering school had established separate branch libraries.

In 1954 a library committee was set up to plan the necessary expansion. The committee worked closely and intensively with the University architect's office over the next two years, exploring ways to expand the original library building by reorganizing the services within it and constructing an annex at the back to meet an anticipated growth to 2,000,000 volumes by 1975. The committee recommended relocating the heavy service departments-circulation reference-to the west side (the original approach and entrance was from the north) to face the newly-planned student union building and consequently accommodate the new shift in the student center of gravity on campus.

An architectural firm was hired to develop schematic drawings for the addition to the library building. As the work progressed one problem became clear: moving people through the building was difficult because of the central position of the original stacks. These stacks were constructed as a self supporting metal system within the building shell with closely spaced floors not corresponding to the main floor levels.

The original central campus planning only permitted expansion of the building to follow the pattern which Metcalf refers to as the 'wrap around' solution. Thus, the staff areas and reading rooms formed a hollow square around the stacks, and traffic patterns between the two wings would constantly be forced around the stacks. Floor heights of the addition could never be perfectly reconciled to the earlier building as the excessive ceiling heights of the original reading room would cause a continuous series of ups and downs. The library committee was quite unhappy with the resulting plans. At this point a new development occurred to influence the decision. Simultaneously with the library's growth the College of Arts and Science had outgrown its central campus location and a new campus plan was being studied which placed it in new buildings forming the new North Campus. Since the departments in the Humanities and Social Sciences represented the major users of the Powell Library core collection, this new campus plan, coupled with dissatisfaction at the outcome of the existing library expansion plans, prompted a request for a site on the North Campus for a new library building.

A library building committee was formed with representatives from each of the library department to develop the program for the new building. The whole staff of each department was to submit how much space it required and where it should be located with regard to other spaces (see, for example, the proximity chart on p.88). Financial guidelines were established by the office of the Vice President for planning and construction amounting to roughly $5,000,000 and general formulas for area standards established by ALA and the State Department of Finance were followed in setting the building program (see hypothetical space standards on page 89). A building of 280,000 usable square feet to be built in two stages was eventually proposed, and approval was obtained from Berkeley to hire an architect.

On review the State Department of Finance refused to support the new library because the University was abandoning a major building "without any very good plans for using it". Instead the plan for expanding the old building would be financed by the State.

In order to convince the State a new building should be built the University engaged Keyes Metcalf as consultant. Metcalf succeeded in convincing State officials to support plans for a new building by demonstrating the false economies of improving the older building with an actual walk-through. This argument, later summarized in a written report, is a model of the decision process involved in determining the desirability or undesirability of constructing a new building. Therefore, because this problem is so often met in Army technical library situations, the Metcalf report has been summarized here.

The Metcalf Report. (24) The report begins by listing the various alternatives open to an existing library faced with expansion. These are:

1. The 'wrap around' solution, referred to earlier and the original course chosen by the UCLA library.
2. A separate storage building for little used books to handle the overflow.
3. The reduction of the core collection by dispersion into departmental branch libraries spread throughout the campus.
4. The 'horizontal' division of the collection by users rather than subject (i.e., graduate and faculty or undergraduate as opposed to music, library science, fine arts, etc.).
5. A new building on a different site, the alternative then currently proposed by the library building committee.

He evaluated each of these solutions in turn, clearly indicating which he considered preferable.

1. He emphasized the unworkability of the 'wrap around' solution due to poor circulation patterns between departments, caused by the central location of the stacks and the unreconcilable floor levels.
2. Although himself a strong advocate of library storage buildings, Metcalf stated the UCLA collection was still too new and small, and would not warrant separating out less used books for storage until it reached 2.5 million books..
3. The same was true of the third alternative. The collection was still too small to warrant breaking it down into several decentralized branch libraries. The separate units could not be operated economically.

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(24) Metcalf, Keyes D. The UCLA Library building program; a report to the librarian. Mimeographed. 20 May 1960.

4. Plans had already been studied at UCLA for creating a separate undergraduate library oriented toward the student union building by adding a wing to the existing library building. Metcalf concluded this would be a poor use of money since (a) the addition would encroach on valuable open space at the center of the campus, and (b) the graduate and faculty library would remain in its old location, no longer central to its users in the Humanities and Social Sciences who were in the process of relocating on the North Campus.

Metcalf then concluded that only the fifth alternative, to build a new library for graduate student and faculty use on the North Campus, made sense; anything less could not provide for the long range needs of the university. The remainder of the report was concerned with how the core collection could be separated into a series of staged moves into the new building, to be built in three increments, and with suggestions for the various sizes and distribution of functional space, with some indication of cost for the new building.

This report, coupled with the critical tour conducted through the old library for the State Finance officials, won the day for the new building. Plans were drawn up for the first unit of the new University Research Library, working from the program previously prepared by the library building committee. As mentioned before, the University of California required that a fully-determined space requirement program be prepared for the executive architects in advance of hiring. This was done by the committee and although the architects subsequently made some changes to the program (required to meet the fire code and building regulations or in the interest of achieving good circulation patterns) the changes were relatively few in number.

As consultant, Metcalf's role went considerably beyond preparing a financial plan for the building. He was active over a two year period, reviewing the revised program, the preliminary drawings, and making recommendations for locations of services in the building. At his suggestion the floor was strengthened to make it possible to increase the number of aisles in a shelving bay from five to seven with the consequent increase in storage capacity.

Simultaneously with the preparation of plans for the new building, it was decided to convert the old building to its current use as an undergraduate library. Subsequently both Units I and II of the University Research Library have been built.

The entire project, although covering an extremely long period of time and involving more space and cost than most Army technical library facilities, can serve as a model for the process of determining what methods should be used to secure needed space. They include:

1) Listing all feasible alternatives for the local situation.
2) Examining each alternative as to cost, efficient operation and need for future growth.
3) Examining the user population needs and attempting to locate the facility near the majority of users.
4) Examining existing regulations governing choice of alternatives and, if necessary, attempting to change the situation.
5) Employing an outside consultant to examine alternatives from an objective point of view.
6) Providing a detailed analysis of the alternatives to the authorizing agency.

IMPLEMENTATION B.III

HOW HAVE LIBRARIES BEEN BUILT?

Simple observation of library physical facilities in general, whether by visit or perusal of recorded data, confirm the wide range of concepts, goals and solutions that exist. Analytical tables in the literature, furniture and equipment journals, published plans, cost records, etc., all testify to the fact that each library has tended to be considered a unique solution, different from all others. This situation exists despite the fact that all serve the same generic functions, although in different proportions.

The same is true of the processes of implementation. The distinction between Army post and camp versus technical libraries that derived from the acknowledged uniqueness of the latter, applies also to other libraries. Each facility tends to be developed within an organizational system, which is adapted as necessary to respond to the individual nature of the library project: libraries within universities; libraries within educational systems; technical libraries serving industry; libraries serving the various echelons of national, state and local government; libraries supporting professional trade, etc.

A preliminary evaluation of some of the implementation procedures outside the Army indicates that no particularly useful purpose would be served in elaborating them in the context of the goals of this project. None has a significant aspect that would benefit Army technical libraries specifically.

More important to the project is consideration of some of the developing procedures. These are condensed in Section C.

EVALUATION B.IV

HOW HAVE LIBRARIES BEEN EVALUATED?

What is Evaluation?

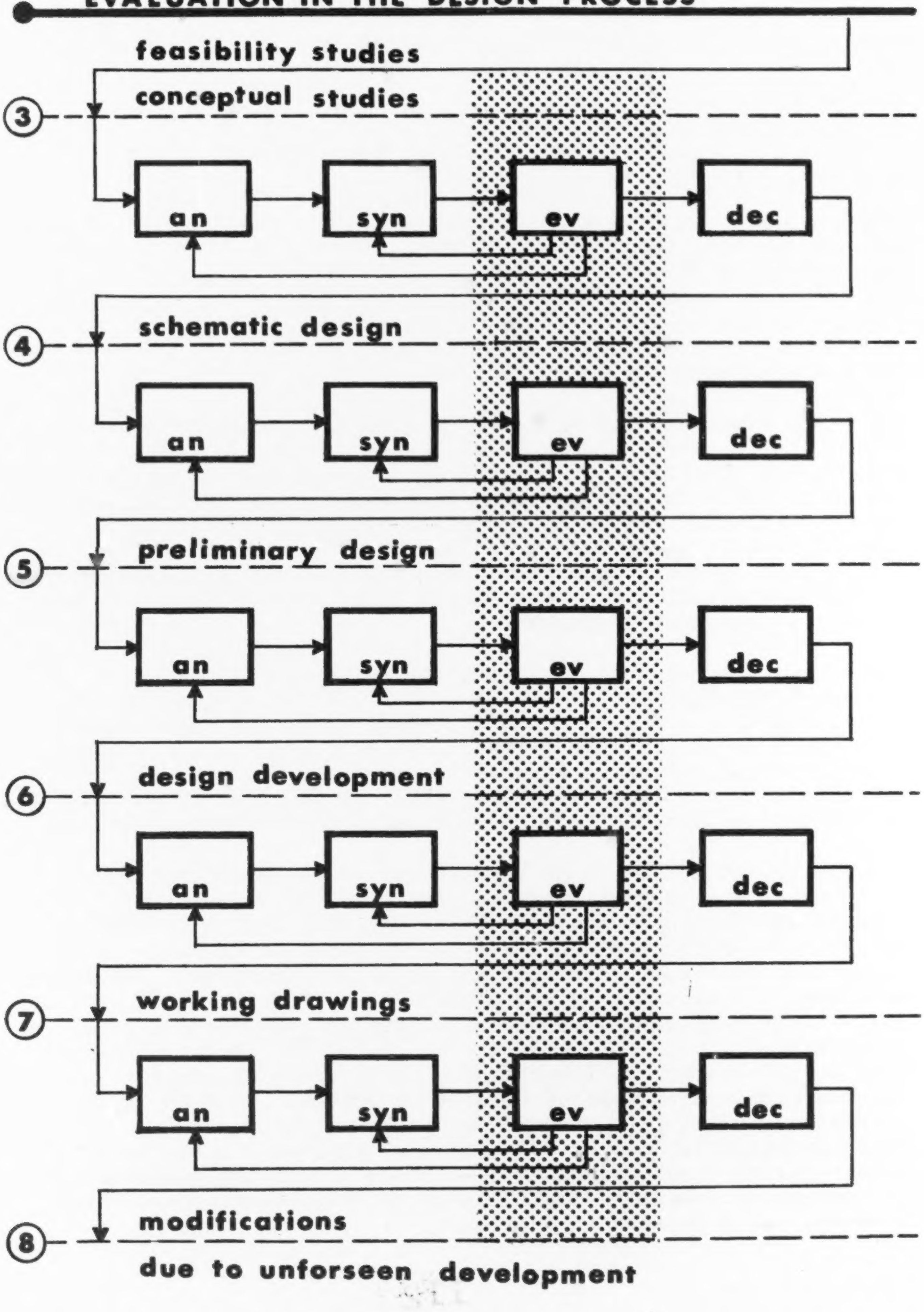
Evaluation is integral to decision making and the design process. As noted earlier, evaluation feedback is very important in the team method of planning and designing a library facility. Evaluation is also important in the post-design, post-construction phase. It serves as a feedback to pre-construction operations and as a check on the actual versus the expected operation of a building and its parts.

Two basic processes can be detected within the current approaches to architectural planning and the design process (see diagram on page 108). The first is a vertical process, sequential in nature and concerned with a progression from the abstract to the concrete. This is reflected in the phases of an architect's work from conceptual studies to schematic design, to preliminary drawings, to design development, and detailed working drawings and specifications of materials and workmanship. At each stage the focus is sharper and the detail greater.

The second dimension of architectural design is a horizontal process, iterative and cyclic in nature. It is a cycle of analysis, synthesis, evaluation and decision, recurring continuously at each stage of the design activity. This is the role of evaluation in design - testing each idea, assessing, modifying or approving it, and then retesting, etc. It is an ongoing activity in the mind of the designer, a constant monitor of his work.

Evaluation, then, can be defined as the appraisal of performance in terms of stated requirements. The focus of the present investigation is on the evaluation of library buildings with particular, although not exclusive, emphasis on the physical layout. It is recognized that more than just the physical environment should be evaluated. Evaluation should consider the total building, including activity and work patterns of employees and building users. This involves the atomization of the social process into activities which can then be interacted with the physical aspects of the building via the use of simulation models. In view of the present unavailability of such complex simulation models, however, this investigation concentrates on what is feasible at the present time. Future developments in evaluation, including possible contributions by computer simulation of activity-environment interactions, are discussed in Section C.

EVALUATION IN THE DESIGN PROCESS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Significance of Evaluation for the Planning Team

The creation of a successful building depends on the productive collaboration of all members of the planning team: the client, the architect and technical consultants. In addition it is important to secure the participation of the user community in the planning process. Various types of building users and all levels of employees can make important contributions because of their differing personal insights into the operation of the proposed building. Since judgements have to be made by all parties involved in every phase of the process of planning and design, evaluation methods provide a framework by which better judgements can be made and better communication facilitated between participants. The following summarizes the special assistance that evaluation offers to each of the individuals involved in the planning of a library.

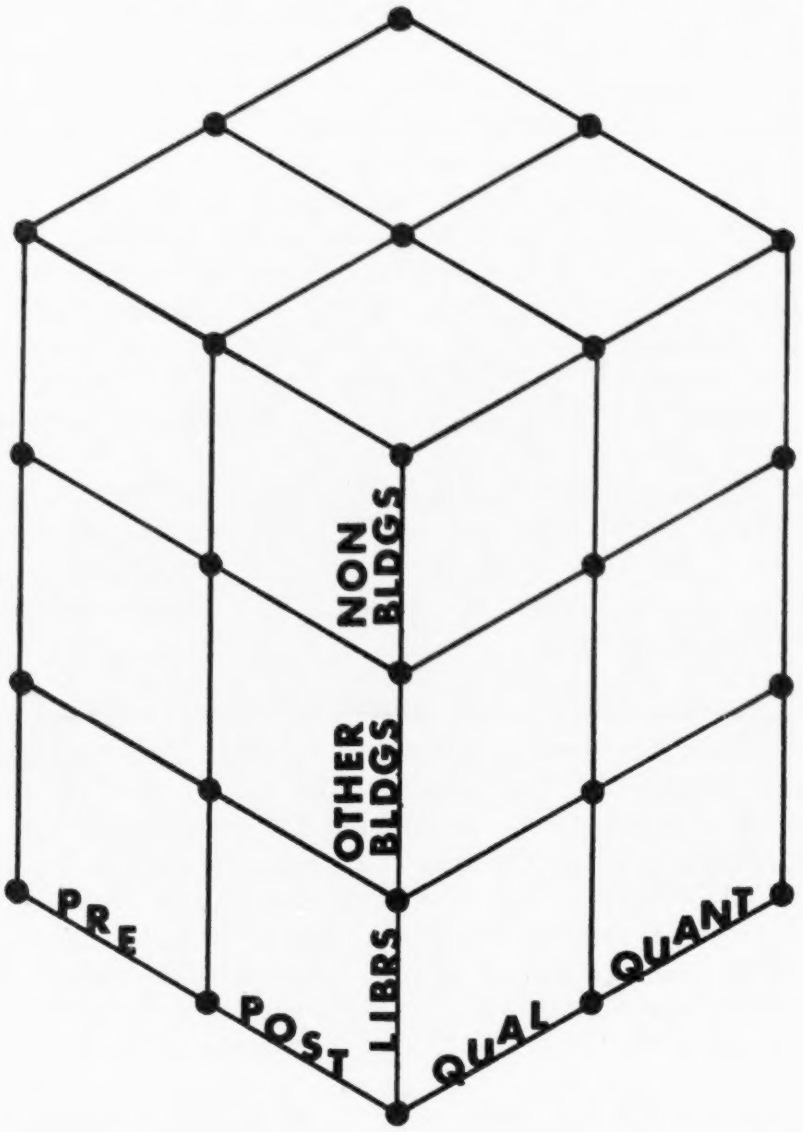
Architect. Methods of evaluation permit the architect to employ his talents fully within the restraints established by the building program. Evaluation helps him reduce the many possible competing alternative design solutions to a manageable number by comparing their performance on selected elements. Finally, continuous evaluation facilitates the sharpening of conceptual designs.

Librarian and Building Consultant. Evaluation assists the librarian by improving his ability to appraise the plans and proposals submitted to him by the architect. The evaluation process also helps to elicit from the librarian a clearer explanation of requirement statements. The more explicit the librarian can make his needs, the more effectively he can evaluate alternatives and give pertinent feedback, the more likely the architect will be able to translate a multitude of requirements into a successful building. Thus, the evaluation process facilitates successful collaboration and communication between the librarian and the architect by contributing to the development of a common understanding. Systematic evaluation may also make explicit the costs and benefits in trade-off situations. Data of this type provides a clear and deliberate rationale for decision making. Finally, in the post-construction phase, when the building is occupied and in use, a program of periodic evaluation of operations provides a basis for the librarian to make changes to permit a more efficient utilization of space in response to changing needs.

Administrator. The evaluation process is an important source of information for the administrator. By reviewing records of evaluation decisions he sees how values were established that influenced design decisions and led to certain design features. It puts him closer to the actual design/decision making process. This, in turn, gives him a stronger foundation on which to base his decisions with regard to the proposed building.

Evaluation data is also valuable to the team in another respect. Comparison of pre-construction expectations and post-construction operations can assist in identifying discrepancies and malfunctions. It can also make contributions to the improvement of the evaluation process through the development of new methods. This work ultimately feeds back into the design process by encouraging the development of more sophisticated design theories and methodologies.

EVALUATION MATRIX


NON BLDGS
OTHER BLDGS
LIBRS
PRE
POST
QUAL
QUANT

Research into the state of the art of evaluation can be organized in a three dimensional matrix. One dimension distinguishes between pre-construction and post-construction evaluation, another between qualitative and quantitative measures, and a third separates research in evaluation of libraries from other types of buildings and from 'non-buildings'.

Evaluation of Libraries

Literature dealing with pre-construction evaluation of libraries is virtually non-existent. This was supported by the results of 35 interviews conducted by the project staff, primarily with librarians and library consultants.* Not one of the interviewees was acquainted with systematic pre-construction evaluation of proposed library plans. This state of affairs is particularly disappointing in view of the fact that evaluation of alternative plans or of a specific plan prior to construction, is very important, especially when the librarian is confronted with a predetermined space configuration. Army technical libraries face these problems constantly, and evaluating alternatives could produce a better facility (see page 33 for example of alternatives that should be evaluated in systematic manner).

Post-construction evaluation in libraries is based predominantly on personal observations occasionally accompanied by some statistical data. Most articles seem to describe buildings with the aim of selling them to the reader, and only occasionally incorporate some critical observations.

At first glance, the published descriptions seem rather valueless in terms of systematic evaluation of a specific building. After critically examining the situation, it appeared there might be some value in searching for "a collective wisdom" in a number of subjective reports. Accordingly, it was decided to underline every "element of worth", as well as every adjective or descriptive phrase found in such reports. Upon examination it was discovered that the "elements of worth" fell naturally into several categories such as aesthetics, environment (physical and psychological), flexibility, space, flow, equipment and cost.

Some examples might be of interest. Recurrent elements under physical environment were : climate, sun protection, daylight, artificial lighting (glare, bulb visibility, light fixture noise), ventilation, air conditioning, sound conditioning, temperature control, water-proofing, maintenance problems, safety hazards, provision for the infirm, etc. Psychological environment includes such factors as comfort, effect on user behavior, conduciveness to study and reflection, need for quiet reading, privacy, human scale, pride in building, and psychological problems of certain readers (lack of windows, visual detractions). Under flexibility, words like expandability (both horizontal and vertical), convertability, versatility, changing patterns, double usage of rooms, different user needs, adaptability to future uses, modular planning and moveable partitions, appeared again and again. This list seemed to confirm a previous breakdown constructed to identify the more obvious areas of concern. (See diagram on page 114).

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* See Appendix 4 for a list of librarians interviewed.

In contrast to the predominantly qualitative nature of evaluation found in most literature, a counter movement toward more quantitative evaluation is noticeable. A first step in this direction has been the development of evaluation checklists. An elementary school evaluation form has been recently prepared, based on recommendations of the American Library Association and the National Education Association. (25) This evaluation attempts to assist the library administrator in determining the effectiveness of the library's total program. Although it is primarily concerned with resources, services, and finances, it does include a section on physical facilities, incorporating such measures as per cent of individualized study spaces, area allocated for displays and exhibits, and facilities for viewing and listening activities.

Another effort to produce a checklist type form, in this case specifically to systematize the description of library facilities, is given in an article by Anthony Thompson. (26) It provides a framework for recording vital information about a building which could subsequently be used as the basis for evaluative comparisons. Ten major headings are established such as function and services, site, exterior and construction, equipment and furniture, accommodation and capacity, etc. Under each major heading, subcategories are listed along with type of information required on each. Under accommodation and capacity, for example, quantities for area, shelving, volumes, and seating quantities are recorded for a number of different activity spaces such as entrance, reference, special collections, different reading areas, staff spaces, etc. It should be noted that this checklist looks only at the physical environment of the library and does not analyze user or staff activity patterns.

An article by Paul Castle takes a number of key factors in library design and studies their application to five university libraries in England. (27) The method adopted was to draw up a list of desiderata, visit the libraries, receive user criticism, and tabulate the results in a form suitable for comparison. It attempts to create means which may be used in examining buildings in use. The study divided into the following categories of investigation:

a. Size - volumes housed, gross floor area, number of reader places, ratio of reader places to books stored, etc.

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(25) Brewer, Margaret; Willis, Sharon. The elementary school library. Shoestring Press, Hamden, Conn. 1970, pp. 88-101.
(26) Thompson, Anthony. Library planning: principles and plan types. In: Architects Journal, 141:8 (24 February 1965).
(27) Castle, Paul. Five university libraries: a comparative study. In: Architects Journal, 147:10 (6 March 1968) pp. 561-77.

EVALUATION CRITERIA

- **SPACE**
  - books
  - equipment
  - staff
  - users
  - special
- **FLOW**
  - books
  - equipment
  - staff
  - users
  - special
- **FLEXIBILITY**
  - adaptable
  - expandable
- **ENVIRONMENT**
  - psychological
  - social
  - physical
- **AESTHETICS**
  - exterior
  - interior
- **EQUIPMENT**
  - equipment
  - furniture
- **COST**
  - construction
  - maintenance
  - operation

b. Character - cognition, circulation, convenience.

c. Environmental conditions - heating and ventilation, lighting, noise-disturbance.

d. Adaptability - permanent structural restrictions, ventilation and temperature control, lighting and ceiling height, potentially interchangeable bookstack/reader space.

e. Expansion - phased construction.

Twelve tables compare statistical data for the five universities on each of the categories listed above. These tables provide a useful overview of the comparative characteristics and relative efficiency of the five libraries investigated. The data presented for the five British university libraries represents a significant achievement in that it established common measures on which to compare the different buildings.

In other published descriptions of libraries, however, there is little commonality and a good deal of confusion as to which measures should be utilized and how those measures are to be defined. A study sponsored by the American Library Association attempts to develop standard definitions and procedures by means of which library buildings may be effectively described and compared. (28) It provides precise definitions for quantifying such factors as: total area of building, area of building usable for library purposes, capacity of building in books and seats for readers, cost of building on a cost per square foot basis, cost of furnishings and equipment. While this is most useful for cost and area comparisons, it covers only a narrow segment of evaluation concerns.

The British system described is the only comprehensive system of library evaluation encountered in the literature search. In Appendix 2 evaluation techniques for other types of buildings are discussed along with an example of how a non-library building evaluation technique could be applied to a library.

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(28) American Library Association, Library Administration Division. The measurement and comparison of physical facilities for libraries: a study by the Ad Hoc Committee on Physical Facilities for Libraries. A.L.A., Chicago, 1969, 17 p.

The Evaluation Process

From the previously presented information on the state of the art of building evaluation, certain principles can be abstracted to comprise a generic evaluation process, applicable to all buildings, both pre- and post-construction. The steps of the process are listed below followed by a brief discussion of each step.

Generic evaluation process:

1. State element of worth.
2. Define its scope.
3. Determine how it is to be measured.
4. Determine standards for performance.
5. Evaluate element in terms of standards.
6. Introduce weighting factors to permit aggregation.

State element of worth. An element of worth is a particular aspect of the activity environmental system that has significance in terms of building performance. This step involves the statement of the particular element to be evaluated. Some examples of elements of worth are daylight, privacy, efficiency, flexibility, etc. It is important that all members of the design team be involved in determining the elements of worth to be considered.

Define its scope. Elements of worth may be stated so as to contain a number of sub-components. This step involves the determination and listing of the sub-components of a particular element that is to be considered. The element privacy, for example, contains a number of sub-components such as visual privacy, privacy from noise, privacy from through traffic, etc.

Determine how it is to be measured. This step involves two parts: first determining what to measure, and then determining the units or manner of measurement. The first part involves deciding what particular "manifestation" characterizes the element or sub-component in question. Visual privacy, for example, may depend on whether the individual in a certain space is capable of being seen by others, or if he is shielded from visual distractions. The second part involves the selection of a particular way of measuring the element defined. Measurement can be both qualitative and/or quantitative. In the case of visual privacy, for example, measurements could be made of possible angles of vision in and out of a particular space (quantitative) or a user could be asked to express his subjectively perceived sense of visual privacy on some measure such as a semantic differential scale. It is obvious that some measures may be precise and objective in nature while others are less precise and open to subjective interpretation. There is a large literature on the philosophy of measurement which addresses itself to these issues, and a comprehensive discussion will not be attempted in this presentation. As a guideline for practice, however, it is important that the reliability of the measure(s) chosen be made explicit in the evaluation process.

Determine standards for performance. There are several levels at which standards are determined. Some may be set at the national level, others at the regional level which are influenced by culture, climate, etc., of the area, and still others which apply only to special types of buildings such as schools, hospitals, or libraries. Standards (such as a required percentage of daylight) may have been established by recognized institutions, or they may have to be developed independently by the planning team. As discussed in the part of the report on standards, discrepancies and inaccuracies presently exist in standards utilized for libraries. Accordingly, predetermined standards may have to be abandoned if they are not suitable for a particular project, and new ones established.

Standards may be suggested by requirement statements and specifications, and should be determined so as to permit an objective comparison for measures obtained. If the measures are quantitative, the standards should also be quantitative. If the measures are more subjective, the standard should specify a certain criterion level that must be reached. If there are a number of plans to be compared, it may be possible to merely establish the best plan as the standard. When there is only one plan to be evaluated, however, there must be some "absolute" level for comparison.

There is also another dimension to the setting of standards, separate from elements of worth, in that it permeates all considerations of the physical evaluation. That dimension is cost. (A closely related additional dimension, time, can usually be expressed in terms of cost.) Cost has two components: construction costs and operating costs. The latter consists of the maintenance of the physical apparatus of the building and the cost implications of certain physical design features for social process, material flow, and task accomplishment. For example, an inefficient physical layout incurs the costs of unnecessary user and staff inconvenience, and may involve hiring additional staff. These implications can be ascertained in a time-motion sense, but also in terms of the general emotional climate of employees and users. These long-range cost considerations are an essential part of the evaluation process, and should not be overlooked.

Evaluate elements in terms of standards. This step involves the comparison of measured data on performance with established standards. Information gained in this step can serve as feedback to modify or change certain aspects of the design in order to change the measured performance of certain element(s) in question.

Introduce weighting factors. Weighting factors are a mathematical method of representing the importance accorded certain elements of worth by members of the planning team. They are a result of value decisions made either during the writing of the requirement statements or during the evaluation process itself. Once these weighting factors have been introduced, there are two possible courses of action leading to the next level of evaluation. First, all of the measurements for a single element can be aggregated for all the different activity spaces of the building. Placing these aggregated values for each element side by side provides a profile of the total plan in question. Alternately, the planning team may decide to aggregate all elements of worth for each activity space separately, providing a profile of the relative value of each space. For a final level of evaluation, additional weighting factors would then be introduced which, in the first case, would establish the relative importance of competing elements of worth, and in the second case would establish the relative importance of various activity spaces. It is debatable as to whether this final evaluation procedure leading to a single quantitative expression for the total design is advisable or meaningful in terms of actual decision making processes. Rather, the use of previously obtained profiles might prove a more realistic aid to the decision making team.

Evaluation procedures are essential to the success of any building program but are critical in a continuous program such as exists in Army technical libraries. Although the Corps of Engineers does not build or remodel a new technical library every year or two, within the Defense Department there is a continuing program of library development and expansion which includes physical facilities. A carefully formulated evaluation process providing feedback to the planning teams as shown in the diagram on page 108, would help improve the chances of securing the best possible facility. While there is no comparable organization other than the Federal government with a continuous need for library facilities, the evaluation process is just as essential to the one time program. Perhaps in one sense it is more important, since there will be no opportunity to correct mistakes. In such a case, the need to evaluate at all stages of the program is critical. It would be desirable to develop an evaluation system, using some national group such as ALA as the clearinghouse for information on the successes and failures of building programs and thereby gain some of the advantages of serial building.

DATA COLLECTION B.V

WHAT STANDARDS HAVE BEEN USED?

This part of the report deals with the problems of determining how much space, light, heat, equipment, etc., should be allocated for the needs of the library. We feel the ideal method of planning and designing a facility is to first approach the design problem from a function and activity point of view without tying the functions or activities to physical aspects. It is important to define the ideal relationship between functions and activities without attempting to specify the space and location within a structure. For example, many existing building programs attempt the following: activity A must be next to activity B, each must have 250 square feet and must be located next to the loading dock which must be on the first floor. Such statements create a great many confusing constraints making it more difficult to design innovative and efficient library buildings. This is the basic reason we have chosen to separate the discussion of defining library needs from the statistical data, standards, codes, regulations and recommendations regarding specific allocations of space, equipment, light, etc. Other reasons relate to the flow of the material and how it must be integrated into the entire design process. We see data collection as a necessary and complementary aspect of the design process rather than the central issue.

Most units in the following discussion contain summary tables of the data available. The accompanying narrative will provide, whenever possible and/or necessary, information on how the reported recommendations were determined. That is, were they based on tests, experience, or do they merely represent someone's idea of what should be used. Each unit is also independent so the reader may consult any unit without a loss of meaning. In many respects this is a reference source for the preceding text. Some of the data will be useful during the pre-planning activities, some during the design development, some during the determination of furniture and equipment requirements, and some during evaluation work.

Army technical libraries will find many of the following units of use in planning their facilities. The basic reason for this is the lack of data of the type given here in a format relating specifically to Army technical libraries. Because of the wide range of potential users, changing missions and environments, changing modes of operation, and the need for overall flexibility, we have included data from all types of libraries. In addition, this data will provide the proper broad data base from which to develop specific recommendations for Army technical libraries in Phase II.

Nature of the Data

Most of the data presented in this section is quantitative. However, we have come to realize this does not mean the data is more reliable or useful than qualitative statements for planning a specific facility, assuming the objective is to achieve the most functional facility possible. Quantification alone does not mean the problem is understood. Sometimes quantification techniques are employed when the situation is improperly defined. The result is a false sense of preciseness and an unsatisfactory solution.

There seems to be some evidence that one of the contributing reasons for poorly functioning library facilities is an over-reliance upon quantitative data of questionable derivation by persons involved in the planning process. This reliance is exhibited equally by librarians, architects and administrators. For example, it is recommended library floors be designed to carry a live load of 150 lbs. per square foot. Is this figure required in certain building codes? The usual answer is there must be flexibility in the library so that book-stacks can be placed anywhere, not because of code requirements. Why 150 lbs. per square foot, why not 140, 160, 200, 125, etc.? Is the recommended 150 lbs. /sf based upon tests, previous practice, assumptions, or correlation with some "similar loading problem"? Apparently the figure is not based upon a program of testing library requirements. Years ago one shelving manufacturer said 150 lbs./sf was required for his shelving unit. It certainly must be adequate; we are not aware of any properly constructed floor, using 150 lbs./sf live load capacity, failing under normal library use. It could be, however, the figure is in excess of the total load requirements, including a safety factor. (Note this is the standard figure used by the Corps of Engineers.) Perhaps requirements have changed; at least one library under construction is using a lower figure. The point is to emphasize the need to examine the recommendations with care and to determine the basis for them. This need appears to be evident even for something as widely used as floor loading requirements.

There are three basic factors to be considered in examining the data available: specificity, source, and derivation. The planning team is faced with a great many codes, standards, regulations, and recommendations concerning a number of aspects of the design process. Some codes and regulations may have been drawn up on the basis of current data and continued in use long after the situation changed.

Professional standards for various types of libraries seem to follow a cyclical pattern: during one time period the emphasis is placed on quantitative definitions while in another there will be an insistence on qualitative factors. This creates problems of correlation. As with all standards there is the question of whether they are minimum standards, ideal levels to be achieved in the future, or something in between.

In 1968 Launor F. Carter commented on standards:

> "The standards established in many settings tend to be arbitrary and without a good empirical base . . . Indeed, in discussions with staff members of the ALA with regard to the setting of standards, the conclusion was always that standards are a matter of professional judgement. . . Yet there is little or no evidence that these standards either lead to the proper level of resource for a particular kind of school or public facility or that they, indeed, lead to better information transfer." (29)

Adding to the problem of determining what data to use is the overabundance of periodical literature of the "how I planned my library" type. Usually these articles contain a list of recommendations, some specific and some general. Many of the statements are paraphrases of recommendations drawn from existing standards or from a few leading building consultants. The few remaining new recommendations need to be examined very carefully just as do all of the recommendations made by the leading consultants in the field. Are the recommendations based on experience and use alone or are they the result of a testing program (formal or informal)? The basis for standards and codes is usually quite clear; with individual recommendations the problem is very complex, especially if an informal testing program was supposed to have been employed. In such cases the whole spectrum of methodological questions needs to be answered before deciding the matter.

Specificity. As will be seen in the following units there is a wide variety of recommendations, codes, data, etc., on the same topic, making the determination of which one to use extremely difficult. These include highly specific requirements such as Army Regulation 415-31 which allocates a maximum gross of 2,500 square feet for a library serving a base with a military strength of 1,500, to highly generalized statements such as "size adequate for good reading and study conditions." (30) Somewhere between the two extremes is the logical solution to the problem. Both extremes have some basis and validity; however, it is clear in some circumstances highly specific allocations simply will not provide adequate space. On the other hand it is equally clear that generalized statements are of little value to the planning team. What is needed is a system derived from an analysis of library activities, capable of providing specific data of a type useful in planning. For example, rather than allocating a maximum number of square feet for a library it would seem more appropriate to allocate space on the basis of various activities carried out within the library and use the sum of the activities to determine the final size. This is not to say other factors such as costs, personnel, land availability, etc., will not, in part at least, determine the final size, but rather to emphasize the need to first examine the activities and their space needs. It is a rather rare occurrence to have a successful efficient library operating out of spaces in which the activities were forced into a predetermined area regardless of the needs of the library program. It is not uncommon to find many new academic library buildings cramped for space within a few years of occupancy rather than the planned 20 to 25 years of growth. In the case of academic libraries, most are relatively free from regulations regarding space allocations yet they continue to have problems. Could it be the basis for planning (data base) is faulty? In the case of libraries constrained by predetermined maximums the problems become very acute.

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(29) Carter, Launor F. Some major issues regarding the future of library service. System Development Corp., Santa Monica, Calif., 1968, 21 p. (AD 837 355).

Source. The source of the data is of importance. Institutional codes and regulations often create problems for the planners unless these documents are used as guides rather than inflexible laws. Normally codes and regulations are drawn up to cover a great many individual cases; however, unless the flexibility aspect is clearly understood, the individual nature of each situation is lost in the process. The planning team should determine how much latitude is available at the outset rather than assuming the situation is fixed.

Standards, especially those developed by professional organizations, are frequently drawn up by a committee. The authority behind the standards as well as the sanctions to be applied for failing to follow the standards vary widely. In most cases there is little likelihood of any sanction, probably because it is clearly understood the standards are not as sound as they ought to be. Some of the standards are from organizations which may have an economic stake in the application of the standards; for example, lighting levels recommended by engineering societies. Data of this type is always somewhat suspect because the recommendations may contain some element of self service and result in a greater expense than might be necessary. Seldom would this recommendation result in inadequate levels; however, the cost of accepting the levels could result in shortages in other areas which would be just as detrimental to the overall performance of the facility.

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(30) Evaluative criteria. 1960 edition. National Study of Secondary School Education, Washington, D. C., 1960.

Recommendations from individuals represent another source of planning data. As noted earlier there is a wide range in the qualifications of the individuals making the recommendations. Leading consultants differ in their recommendations (as will be noted in later units); this places the planning team in the position of having to choose between "leading recommendations". Who is correct? Does anybody really know? Will a guess make do? All too often the result of the analysis of such recommendations is a variation for local use. This in turn frequently results in an article being published providing another category of recommendations, the "how we did it at _______" type. If the planners have difficulty evaluating the recommendations of leading consultants it is even harder to evaluate the case history recommendations. There are so many problems in evaluating these materials most planners simply ignore the source. This may be less time consuming but may also be detrimental since some of these sources contain useful recommendations.

Derivation. Derivation is probably the most important factor of all. If one has adequate information about the method used to produce the recommendations the problem of evaluation is greatly reduced. However, there is very little information on methodology. In many cases it is doubtful there is anything to back up recommendations other than repeated non-failure use. Non-failure use as opposed to successful use means the recommendation did not create a problem or fail. This usage is quite different from implying that the recommendation created a truly efficient result. The difference here is between adequate and best solution; just because the solution works does not mean it is the best solution. As with all decision making the search in library planning should be for the best possible solution. For one reason or another it may not be possible to use the best solution, but, having defined the best, it is possible to evaluate the solution employed. In library planning it often appears as if the first adequate solution encountered is used, without any attempt to search for better alternatives.

As will be noted in the individual units on various aspects of planning, there is a considerable range in derivation. Some recommendations are based upon careful testing and retesting carried out by parties who have no vested interest in the outcome. The Library Technology Program operated by the American Library Association issues regular reports on its testing program; these are an example of reliable material. The LTP testing is concerned with testing various products and equipment being sold to libraries. In many ways LTP resembles a consumers' testing organization. At another level are the testing programs of groups who have some financial interest in the results. Such test programs are subject to bias and securing enough data about the test program to evaluate the bias is time consuming. More often the question is not one of bias but rather a lack of comparison with alternative methods of solving the problem. On still another level are the local tests conducted in mock ups for a specific facility. While there is little question that this "testing" is unbiased there are several problems. First of all, how effective can the local program be? Expensive or sophisticated testing equipment is seldom available and most of the testing is oriented towards psychological impact. Second, because the "testing" program is geared to planning a new facility, there is a limited amount of time available in which to conduct the program. There is seldom enough money available to hire experts to conduct and evaluate the tests. Finally there is never enough money or time to conduct more than a very few comparative tests. In all the testing programs the importance of the comparative element cannot be over emphasized. Without a comparison very little useful information is derived from a testing program, especially when the planners must use data for similar solutions but from different testing programs. Ideally all the tests would be conducted by the same groups at the same time covering all available solutions for a given situation. The closest the library profession can come to this ideal is the Library Technology Program. Even this is limited in scope and at the present time it appears as if LTP will be cut back, limiting its effectiveness.

Most of the data are not based upon any form of testing as far as can be determined. This is as true of institutional codes and regulations as it is of individual recommendations. Nevertheless, many of the recommendations are in continuous use and most of them are of the non-failure type. Until such time as they are or can be tested they will continue to be used from necessity.

Because of all the problems in evaluating the data some feel the planning team ought to ignore all the data sources and proceed on its own. It seems unlikely this extreme position is really tenable because of the high risk involved. The problem is rather acute. As one of the library consultants interviewed for this report said, it is so confusing that planners must ignore all the data sources and work only from observations. Hopefully with a sound testing program this feeling would be eliminated and the planning and resulting facilities would be greatly improved.

Functional Requirements

General Space Allocation--Any Type of Library

All of the data found on the number of square feet needed for any type of library were very specific and divergent. The table on page 127 presents a summary of some of the data. Considering how many square feet should be allocated per reader station, the range is from 25 to 40 square feet. The architect caught in the middle might be tempted to push for 30 feet per reader. This is not an uncommon occurrence as will be seen in subsequent units--highly specific data yet highly unuseful for the planners' needs. Does the 40 foot figure allow for something extra not covered in the 25 foot figure? There is no way of determining this short of contacting the individuals responsible for the recommendation. Resolving the hundreds of unknowns of this type would delay the planners for years if they felt they needed all the answers.

Which figure is correct? Correct in terms of what might be a better question. Readers can and do work in spaces of less than 25 square feet. The problem seems to be one of performance rather than space. A person reading for relaxation needs one type of environment or at least may find one environment more conducive to recreational reading than another. Several different environments may be equally stimulating. Each environment in turn would have its own combination of factors resulting in different space requirements. For example, some people may enjoy sitting at an individual study carrel, while still others may like to read on a sofa. The space needed to accommodate one reader in each case is quite different and this does not even touch upon all the other "reader" or patron activities to be considered in a library (studying, listening, viewing, talking, etc.).

In the allocation of space for books there is a consistent pattern as will be evident in all the sub-units. There seems to be a general agreement on 1 square foot per 10 volumes. Using this guide, how many books should be included in the calculations, how much future growth anticipated? Based on past experiences of libraries there is never enough space. Growth is more rapid than predicted; however, it is not all due to the growth of collections but also to new services and patrons. Factors of this type are almost impossible to predict unless no growth is to be allowed.

The sources of the recommendations in the table on page 127 are quite varied. The material from the Architects Journal represents an attempt by a professional journal staff to provide information for its readers. Since the architect has very little at stake here one would think the data would be objective. It certainly would appear to be since the recommendations are rather conservative. The American Library Association, Library Administration Division, developed information to aid planning teams in estimating space needs. Overall the space allocations are more generous than the British figures. In the third column, Klausner's material is still more generous and probably reflects a desire to get as much space as possible because the shortages will arise soon enough. Again this is a librarian writing for librarians and some administrators would question the validity.

As for the derivation of data in this table, only the Architects Journal indicates anything about methodology. The AJ material was abstracted from a survey of European libraries. While the data is objective and reflects current building programs, is it useful? Such an approach tends to perpetrate and give credence to current practice without examining the basis and need for the practice. Present practice in any field is a useful guide but only when its purpose is validated through testing or moved beyond the present state of the art. The ALA material and Klausner's data give no indication of a survey or testing program.

Conclusions. Of the material presented in the table the only agreement is on the allocation of 1 square foot/10 volumes and an estimate of 7 volumes per linear foot of shelving. From experiences of recent libraries the allocation may be too small; however, until it can be checked it is a useful approach.

The other information is so divergent it is of little use. In terms of reader stations an average of 30 square feet/reader might provide adequate flexibility until such time as space requirements for various activities are determined. For the staff both the AJ and the ALA figures are very close to the average figure given for most office activities. This presents a problem in technical services because the activities require more than just a typing or filing station. The materials being handled are bulkier than most office materials and thus require additional space. Again in the absence of anything else one must make do with only partially satisfactory data.

Areas in need of work are:

1. Determining space requirements for individual activities.

2. Examining methods of determining space per population served and patron stations per population served.

3. Examining the validity of the space allocation for collection storage.

GENERAL SPACE ALLOCATION

ANY TYPE LIBRARY

	1	2	3*
FLOOR AREA	pop served / sf/1000 pop 20,000 450 35,000 420 65,000 375 100,000 335 100,000 up300		
READING	25 sf/reader 24 sf/child	5 seats/ 1000 pop 30 sf/reader	40 sf/reader
PUBLIC SERVICE	60% of total area		
CIRCULATION, TECHNICAL SERVICE	40% of total area		
STAFF	75-150 sf/staff	125-150 sf/ staff	
BOOKS PERIODICALS	7 vol/Lf	6-8 vol/Lf or 10 vol/1 sf	10 vol/1 sf

* based on Wheeler & Githens V.S.C. formula

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

1. Library planning 2: space standards. In: Architects' Journal, Information sheet 1318 (24 February 1965).

2. American Library Association, Library Administration Division. Library facilities - an introductory guide to their planning and remodeling. A.L.A., Chicago, n.d., 6 p.

3. Klausner, Margaret. The library program; its purpose and development. In: News Notes of California Libraries, 52:3 (July 1957) pp. 523-31.

General Space Allocation-Academic Libraries

In the past twelve years there have been several major summaries of the state-of-the-art in academic library facility construction. Ralph Ellsworth prepared one in 1959/60, Keyes Metcalf's book appeared in 1965, this survey will include 1970/71. We find the situation has changed little and hardly improved in that time period. In comparison to the amount of literature produced on aspects of the planning, design and construction process, very little concrete improvement has been attempted, much less achieved. Areas of research identified by Ellsworth over 10 years ago (see the conclusions of this sub-unit) are still in need of work and in question today.

Some of the material is very specific but contradictory, or at least not in agreement (see the table on page 131). For example, on space allocated for staff working areas there are four different specific square footages and two different percentages of space suggested. In this case even the percentage base is not the same.

Where did these recommendations come from? Two leading consultants are included in the table (columns 2 and 4) as well as a number of less well-known individuals. Almost all of the recommendations of academic library associations are qualitative and non-specific -- of little help to the planning team. Knowing the origin of these recommendations puts planners in the position of having to choose between a number of qualified sources.

What were the bases for these recommendations? Most of them are based on experience or surveys of what others have said (columns 2,4,5,6,7,8). The square footage allotment for books in column 1 is based upon Matsler's report. L. White (column 3) sent a questionnaire to academic libraries and the figures given represent averages based upon current practice. The Matsler study (column 10) is based on a survey of existing academic library facilities in California and the figures represent the average in terms of current use. Of most use in column 1 are the estimates for non-book materials, something that is often overlooked. Both Metcalf and Ellsworth (columns 2 and 4) include current practice in their figures and both are very cautious about recommending anything. This is understandable since conditions do vary from library to library. However, some general guidelines ought to exist to aid the planning team in coming up with a first reasonable estimate of space needs. Having once established this base it is then possible to take into consideration all the local variables and arrive at a firm statement of space requirements. None of the recommendations are based on studies of what the best space allocation might be.

Conclusions. As none of the recommendations have been tested except by repeated non-failure use, there is nothing to recommend for permanent usage. In terms of interim use until studies can be conducted several points can be suggested as temporary guides:

1. Allocate .1 sq.ft./per volume of existing collection
2. Allow seating and study space for 25% of the student body
3. Allow study space for 10-15% of the faculty
4. Allow 25 sq.ft. per reading station
5. Allow at least 100 sq.ft. per library staff member
6. Allow at least 45 sq.ft. per faculty member

All the areas are in need of controlled studies to determine what figures should be employed. We know successful facilities have been achieved using some of these recommendations and other facilities have been less successful. A detailed exploration of which recommendations have been used in "successful" libraries and which in less successful might provide useful insights into which figures to use. Studies of the real space needs rather than current practice would provide valuable information.

Most of the areas in need of examination were identified by Ellsworth in 1960 (31). These were:

Space for Books:	The concept of open or closed stacks is not based upon evidence but on emotional considerations. Deciding to use an open stack approach greatly increased the number of square feet required. Evidence on the usefulness of the open stack concept needs to be sought.
Space for Readers:	We have nothing to work with in terms of the ideal conditions. This has changed a little during the past ten years with some studies on what types (individual or group) of space readers prefer but very little about how much space or equipment is needed. Much more work needs to be carried out in this area.

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(31) Ellsworth, Ralph. The state of the library art. Volume 3 Part 1: Buildings. Rutgers-the State University, Graduate School of Library Service, New Brunswick, N. J., 1960, 151p.

Space for Nonbook Materials:	We really do not know how much and what type of material should be available; Until the questions of what and how much are answered it will be impossible to provide adequate space for these materials.
Space for Staff:	Given the various forms of systems analysis and work flow study techniques available there is no reason work spaces should be inadequate. Nevertheless, staff areas often turn out to be less than what is really required. Some careful analysis of technical service activities might provide information on whether or not space should be provided over and above normal office space allocations.

GENERAL SPACE ALLOCATION

ACADEMIC LIBRARIES

	1	2	3	4	5	6*	7	8	9	10**
TOTAL AREA						25,000 sf/ 1000 students with 150 staff				
SF/FACULTY	15 sf in reading room	75 sf					46 sf	88 sf	75 sf	
READERS	seat 25% 7.5 sf/fte undergrad 7.5 sf/grad	seat 20-50% FTE 20-35 sf/ reader	seat 33%	seat 30% undergrad	seat 20% undergrad 25 sf/reader plus carrel space: 25% grad pop x 45 sf	25 sf/reader	18 sf/reader station 22.5 sf/listening station 30 sf/carrel	seat 25-50% 25 sf/reader 25 sf/listening 15-20 sf/carrel	25 sf/reader undergrad 28 sf/reader grad	seat 15-20% 25 sf/reader
STAFF	25% of reader space	average of 122 sf/staff			135 sf/staff		20% of reader and book space	100 sf/staff	117 sf/staff average	400 sf [illegible] plus 140 sf/staff
BOOKS	.1 sf/vol for first 150,000 .09 sf/vol for 2nd 150,000 .08 sf/vol for next 300,000 .07 sf/vol over 600,000	4-8 vol/Lf 133 vol/ standard section		10-15 vol/sf	10 vol/sf	17 vol/sf	10 vol/sf		8.7 sf/section (125 volumes)	10 vol/sf 75% bound 25% unbound
MICROFORMS	4 reels to 1 vol								8.7 sf/section (400 reels; 10,000 cards)	
MAPS	9 maps to 1 vol								42 sf/case (1000 items)	
RECORDS	6 rec to 1 vol								8.7 sf/section (500 items)	
FILMS, SLIDES										
ARCHIVAL	1 cf to 15 vol								8.7 sf/section (1000 items)	
PAMPHLETS	15 items to 1 vol								11 sf/case (1000 items)	
MUSIC	15 items to 1 vol									

* University Grants Committee, U.K. Standards.
** proposed standards.

References appear on following page.

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

GENERAL SPACE ALLOCATION

ACADEMIC LIBRARIES

1. Bareither, Harlan D.; Schillinger, Jerry L. University space planning. University of Illinois Press, Urbana, 1968, pp. 64-6.

2. Metcalf, Keyes D. Planning academic and research library buildings. McGraw-Hill, New York, 1965.

3. White, Lucien W. Seating achievement in larger university libraries. In: College and Research Libraries, 28:6 (November 1967) pp. 411-15.

4. Ellsworth, Ralph. Planning the college and university library building. Pruett Press, Boulder, Colo., 1960, 102p.

   ______________. Buildings. In: Ralph R. Shaw, ed. The state of the library art. Vol. 3, pt. 1. Rutgers-the State University, Graduate School of Library Service, New Brunswick, N.J., 1960, 151p.

5. Space guidelines for libraries. Wisconsin Coordinating Committee for Higher Education, Madison, May 1966. (ED 037 047).

6. Fairhurst, H. A new university prospect: II. Accomodating the library in the new university. In: American Special Libraries Information Bulletin, Proceedings, (April 1965) pp. 107-11.

7. Dober, Richard. Campus planning. Van Nostrand Reinhold, New York, 1963, pp. 85-93.

8. Lyle, Guy R. Administration of the college library. 3rd edition. H.W. Wilson, New York, 1961.

9. Unit area allowances for libraries. Mimeographed. University of California, Berkeley, 1968, 6p.

10. Matsler, Franklin G. Space and utilization standards; California public higher education. Coordination Council for Higher Education, Sacramento, 1966. (ED 013 079).

General Space Allocation - Public Libraries

In 1967, after an intensive examination of the literature on public library architecture, Joseph McDonald concluded. "The study of the past twenty five years of public library architecture reveals no significant deviation from the principles set forth by Wheeler and Githens in 1941." (32) The statement is just as true for the past five years as it was for the preceeding twenty five.

Many of the standards for public library buildings are very general in nature and of little use in calculating space requirements. The following are only examples of a type; they were not chosen because they were either good or bad.

> "Space is available in each agency to serve efficiently the many-faceted activities of children's services."(33)
>
> "The physical facilities of a public library should fit the program of library service." (34)
>
> "The building should include adequate facilities for reference, circulation, reading, study, special services, extension and group activities." (35)

As can be noted there is a great commonality in the specific recommendations given in the table on page 135 . The reason is almost everyone in the public library field has gone back to the work of Wheeler and Githens as their base line. Their formula for calculating space, $\frac{v}{10}$ x S x 40 x $\frac{c}{40}$ = t.s.f.* has been used as a standard since their book was published. The formula is based upon experience and examination of plans and data on new buildings. It allows for flexibility in the local situation since it is based upon local information. Supplemented by a formula for future development, years hence (20,30 or whatever), x .10 x 25 = t.s.f., the system seems to provide adequate space for libraries continuing to follow traditional book oriented collections. All of the questions about how much space would be ideal for this or that function still remain to be answered.

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(32) McDonald, Joseph A. 25 years of public library architecture, 1941-1966: principles and trends. In: Public library architecture. Drexel Press, Philadelphia, 1967, p. 24.

(33) American Library Association. Standards for children's services in public libraries. A.L.A., Chicago, 1964, p.23.

(34) American Library Association, Co-ordinating Committee on Revision of Public Library Standards. Public library service. A.L.A., Chicago, 1956, p. 56.

(35) California Library Association, California Public Library Standards Workshop. Public library service standards for California. In: News Notes of California Libraries, 48:3 (July 1953) p. 384.

The planning team might consider using the above formula as a check against other methods or calculating space needs, regardless of type of library. Army technical libraries may be able to use the formula to make a rough estimate of their space needs, checking this against the result of calculating the requirement based on recommendations for civilian special libraries. As its major advantage the formula takes into account the circulation (dissemination) activities of the library which is reflective of the use of the library.

Other systems of calculating space needs tend to be rather static: number of volumes, number of readers, number of staff members equals the necessary space. They do not allow for an interaction of the factors. It is the interaction that makes the difference in a satisfactory or unsatisfactory facility. Two buildings of the same size, design, and equipment, serving the same size population, may be evaluated as opposites, one very satisfactory and the other unsatisfactory. The difference could be in the volume of use of the facility; the heavily used library would be unsatisfactory because of the number of individuals using the building. In general this seems to be one of the weaknesses of all the methods of calculating space allocations. The critical factor would appear to be the dynamics of the situation and only the Wheeler-Githens formula begins to explore this area.

Research in Phase II should include some work on the influence of use and behavior patterns in calculating space needs. This is especially true for the Army technical library systems where no standards exist. Army camp and post libraries could also benefit from using the Wheeler-Githens formula and any modifications suggested by work during Phase II.

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* $\frac{\text{Volumes}}{10}$ x seats x 40 x $\frac{\text{circulation}}{40}$ (annual)= total square feet.

GENERAL SPACE ALLOCATION

PUBLIC LIBRARIES

	1	2	3	4*	5**	6	7	8	9
GENERAL SPACE	V.S.C. formula		BRANCH 5000 sf min/ 25,000 pop 7-8000 sf/ over 40,000 pop		.29 sf/capita	V.S.C. formula	same as column 1	pop served — sf/capita under 10,000 — 1 10,001-35,000 — .68-70 35,001-100,000 — .55 100,001-200,000 — .45 200,001-500,000 — .375 over 500,000 — .35	pop served — sf/capita 0-2499 — 2,000 total 2,500 24,999 — .7 25,000 49,999 — .6
READERS	40 sf/reader	25-30 sf/ reader pop served — seats/1000 up to 10,000 — 4-10 10,000-24,000 — 4-5 24,000-49,000 — 3-4 49,000-74,000 — 2-3 74,000-99,000 — 1.5-2		25-30 sf/ reader 2-3 seats/ 1000 pop	3.6 seats/ 1000 pop			pop served — seats/1000 0-10,000 — 10 10,001 35,000 — 5 35,001-100,000 — 3 100,001 200,000 — 2 200,001 500,000 — 1.25 over 500,000 — 1	pop served — seats 0-2,499 — 13 2,500-4,999 — 16 min 5,000-9,999 — 23 + 4/1000 10,000-24,999 — 40 + 4/1000 25,000-49,999 — 75 + 3/1000
CHILDREN						20-25 sf			
ADULTS						25-30 sf			30 sf after incremental minimum
STAFF	1 sf/40 vol circulated	100 sf/staff		100 sf/staff		80-100 sf/ staff			150 sf after incremental minimum
BOOKS	10 vol/sf	15 vol/sf 100 vol/Lf of double face shelving with 5 foot aisles 1.5-3 vols/ capita		15 vol/sf 3-4 vol/capita				pop served — vols/capita 0-10,000 — 3 10,000 35,000 — 2.5 35,000 100,000 — 2 100,000 200,000 — 1.75 200,000 500,000 — 1.5 500,000 up — 1.25	pop served — vols 0 2,499 — 10,000 2,500 4,999 — add 3/ capita over 3500 pop 5,000-9,999 — 15,000+ 2/capita 10,000-24,999 — 20,000+ 2/capita 25,000-49,999 — 50,000+ 2/capita

* suggest adding 40% to space determined by formula for non-assignable space

** medians of 26 Boston branch libraries.

References appear on following page.

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

GENERAL SPACE ALLOCATION

PUBLIC LIBRARIES

1. Wheeler, Joseph L.; Githens, A.M. The American public library building: its planning and design with special references to its administration and service. Scribner's Sons, New York, 1941.

2. Galvin, Hoyt R.; Van Buren, Martin. The small public library building. UNESCO, Paris, 1959, 133 p.

3. Geddes, A. Leasing our way. In: Library Journal, 86:21 (December 1961) pp. 4088-90.

4. Jenkins, Joseph A. Programming and financing library buildings. In: Libraries: building for the future. A.L.A., Chicago, 1967, pp. 34-8.

5. Grundt, L. Efficient patterns for adequate library service in a large city. University of Illinois, Graduate School of Library Service, Urbana, 1968.

6. Wheeler, Joseph L. The small library building. A.L.A., Library Administration Division, Small Libraries Project, Chicago, 1967, 36 p.

7. McDonald, Joseph A. 25 years of public library architecture, 1941-1966: principles and trends. In: Public library architecture. By Joseph A. McDonald and Donald H. Hunt. Drexel Press, Philadelphia, 1967.

8. Coburn, M. A survey of recently constructed public library buildings in the United States and Canada. Author, Edmonton, Alb., 1963, 93 p.

9. American Library Association, Public Library Association. Interim standards for small public libraries. A.L.A., Chicago, 1962, 15 p.

General Space Allocation - School Libraries

Although at first it does not seem relevant to include school libraries in a discussion of Army technical libraries there is a valid reason for such inclusion. School libraries, or media centers, have done more with non-book information materials than any other type of library, with the exception of the community college library. In the foreseeable future all libraries, and especially technical libraries, are going to have to increase their use of other media (non-print) in order to meet the needs of their users. If the planning of new facilities is to be successful there must be planning for the processing, storage, and use of non-traditional library materials. Therefore, it is useful to examine what has been done in this area in other types of libraries. In a broader sense there are occasions when the Army and the Corps of Engineers must construct some school library facilities for children of dependents. On that basis alone the inclusion would be justified.

The material from the joint committee of the American Association of School Librarians is the most comprehensive. It includes such items as media production laboratory, dark room, small group and individual viewing and individual viewing and listening spaces, audiovisual distribution and storage, service and maintenance area, and studio space. While some of these items may not be included in Army special or technical libraries, it is probable that increased attention to viewing and listening stations will be required. Some organizations are now recording minutes, meetings, and reports on cassette tapes. In the near future many technical reports will be distributed in the cassette format because of the cost of preparing printed reports. Now that sound tracks are available for 35mm slides, data may be issued in this format. Statistical and other data will increasingly be made available in magnetic tape form, thus making it very important for technical libraries to have facilities for gaining access to such data.

As will be noted, there is a rather high degree of consistency in the recommendations. Ten to fifteen percent seating capacity seems to be standard for users; about 200 sq. ft. for library offices; and stack space at one square foot per student or 10 volumes per student. However, the basis for this consistency seems to be agreed upon allocations rather than a careful study of what needs to be done.

In the absence of other data the school library recommendations for non-print material space requirements could be used as guidelines. The area calculations for school media facilities have been set by professional organizations and could be used until such time as new tested data becomes available.

GENERAL SPACE ALLOCATION

SCHOOL LIBRARIES

	1	2*	3	4	5	6**	7	8***	9
READING AREA	seat 10% of pop over 500 45-55 seats min for 200-600 pop 100 seats max	seat 30% pop 60% carrels 15% group study 8% tables 17% lounges	seat 1 class plus 10 for elementary 10-20% pop for high school	seat 10-15% of pop 80 seats max	120 seats max	seat 1 class plus 10	seat 15% of pop 100 seats max	45-55 seats for 200-550 pop seat 10% of pop over 550 80 seats max	seat 15% of pop 50 seats for under 350 pop 50% carrels 100 seats max
SF/READER	30-35 sf	25 sf	25-30 sf	30-35 sf	25 sf			30-35 sf	
COLLECTION SIZE	10 vol/capita min plus 10-25% for growth	30,000 min high school	6,000 min or 10 vol/pupil for max pop		10-20 vol/pupil	10 vol/pupil		6000-10,000 vol for 200-999 pop 10 vol/pupil after 999 pop	
LIBRARY OFFICE		200 sf	100 sf min		120 sf	200 sf	150-200 sf/staff		450 sf****
CONFERENCE ROOM			120 sf min		120 sf		3-6 rooms 150 sf each	120 sf min	160 sf****
CLASS ROOM			800-1000 sf min						900 sf****
PROFESSIONAL READING ROOM		48 sf/faculty							300 sf****
WORK ROOM			200 sf min for elementary 350 sf min for h.s.		150-200 sf		300-400 sf		450 sf****
RECEIVING/SORTING									450 sf****
AUDIO VISUAL		200 sf	200-350 sf		120-200 sf	200 sf	400-600 sf		500 sf****
STAFF		100 sf/staff			1 librarian/65-70 users			1/400 pop 1/300 pop over 900 pop	
PERIODICAL STORAGE			5 yrs. issues: 30 titles are max elementary min high school						100 sf****

* minimal figures for a small school library.
** elementary school library - 1800 minimum sf.
*** library for over 200 students.
**** library for 350 students.

References appear on following page.

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

GENERAL SPACE ALLOCATION

SCHOOL LIBRARIES

1. Hodges, Elizabeth. Physical requirements for good library service. In: American School and University, 33:F (1961-62) pp. F11-16.

2. Ellsworth, Ralph; Wagener, Hobart D. The school library. Educational Facilities Laboratory, New York, 1963, 142 p.

3. Johnson, Marvin R. A. How to plan a good library from scratch. in: The Nation's Schools, 77:3 (March 1966) pp. 103-106.

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6. Corliss, William S. On planning library rooms. In: The American School Board Journal, 147:1 (July 1963) pp. 27-8.

7. Joint Committee of the American Association of School Librarians. Media center facilities. In: Standards for school media programs. A.L.A., Chicago, 1969, pp. 39-49.

8. American Association of School Librarians. Standards for school library programs. A.L.A., Chicago, 1960.

9. Brewer, Margaret L.; Willis, Sharon O. The elementary school library. Shoestring Press, Hamden, Conn., 1970.

General Space Allocation - Special/Technical Libraries

Special libraries in the civilian sphere share many characteristics with Army technical libraries. They both have a clearly defined client population with specific and relatively easy to define information needs. Growth, while a problem, is not usually of the magnitude encountered in academic institutions where the variety of information needs is much larger. Adequate space is still difficult to secure and maintain, and expansion of the facility is a major problem. Both civilian and military special libraries usually occupy space within a building serving a number of functions.

Placement of special libraries within a building is very important. Factors such as accessibility, expandability, and flexibility must be considered. Selecting a below-grade or upper floor location may create a situation in which expansion becomes impossible.* A ground floor location is often difficult to obtain because every department in the building has some logical basis for requesting space on the ground floor. One of the problems is the question of floor loading. Everyone discusses the need for 150 lbs. per square foot, yet we have no real basis for this figure. Spacing of book stacks is more important than consideration of concentrated weight only. Often libraries are placed in the sub-grade levels because of the assumed loading requirement. Until a careful testing program determines what is required we can not make good decisions about the placement of facilities within a building.

The data available on space allocation for special/technical libraries are very specific, but there is a wide range as was found with recommendations for other types of libraries. To suggest that standards and recommendations are only guidelines to be used with judgment is to beg the question. With such a wide range which do you choose to apply with judgment? Do you pick and choose from all of those available, using whichever specific recommendation provides maximum space? Making selective choices does not guarantee that the funding administrator will not be equally selective. This process results in a greatly reduced space request. It is necessary to be able to justify the request. Using a single, fully documented set of recommendations as the basis improves the chances of successfully defending the request. The table on page 142 provides a cross section of types of special libraries and the range of existing recommendations.

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* See also the discussion of below-grade facilities on page 31 of Section A.

Since none of the sources provide data from tests or comprehensive surveys they only reflect local practice and experience. There appears to be nothing in this area to help guide the planners in deciding which set of recommendations is most useful. The sources of the recommendations vary from individuals recounting their own methods to the standards sponsored by professional associations. Each has a slightly variant list and each recommendation was used at least once with some success (or at least did not fail), making the selection process more difficult. It does not come as a surprise to find so many people attempting to generate their own set of standards in view of the existing wide variations.

A real problem exists in determining which recommendations are usable until such time as new tested standards are available. Special libraries generally find less than 10% of the user population need to be seated in the library at any one time. Work space for staff members seems to be set at around 150 sq. ft. per person; interestingly, there is no consideration of special space needs for technical service activities. Space for readers is highly variable (20 sq.ft. - 35 sq.ft.) and, in the absence of any firm knowledge about specific activities, something on the order of 20-25 sq.ft. per person seems reasonable. This is based upon recommendations for other types of libraries. Space for materials is consistent with other types of libraries (10-15 vols/sq.ft.); however, special libraries tend to deal with more report and journal literature which would probably throw the figure off. The areas in need of research are basically the same as those outlined in the unit on academic libraries with the addition of a special study of average number of volumes per square foot in technical libraries. The above figures could be used as interim standards for space in Army technical libraries until such time as a more fully documented set can be provided.

In the remaining sub-units on physical requirements and furniture and equipment, applicability of the data to planning and designing Army technical libraries seems so apparent that no special effort will be made to show the connection. Where the connection may seem tenuous a justification is provided.

GENERAL SPACE ALLOCATION

SPECIAL / TECHNICAL LIBRARIES

	1 LAW	2 PRISON	3 HOSPITAL	4 TECHNICAL	5 SPECIAL	6* MEDICAL
READING ROOM	seat 5-60% of pop	seat at least 5% of pop		seat 7% of 1st 1000 seat 4% of next 2000 seat 3% of pop over 3000	no rule of thumb for no. of readers to be seated	6500 sf
STACKS				$\frac{\text{vol.}}{1000}$ x 81 sf		12,000 sf inc. carrels
OFFICE & WORK SPACE	150 sf/staff	100 sf/worker 120 sf/librarian	150-175 sf/staff		125 sf/staff	2000 sf
NON-ASSIGNABLE SPACE	30%					
SPACE PER READER	25 sf undergrad 30-35 sf grad 50-75 sf carrels	35 sf/reader		20-32 sf/reader	10.5 sf/reader	
BOOKS	10 vol/sf	15 vol/sf 24 vol fiction/ 3 Lf of shelving 15 vol non-fiction/ 3 Lf of shelving	7 vol/sf .3 sf/blind 3.75 sf/staff 5 sf/reference 4.5 sf/technical	10-12 vol/sf general 6 vol/sf technical	100 vols/12 Lf of shelving	12 vol/3 Lf of shelving 500 Lf min Indexes, etc. 300 Lf reserve books

* Ideal areas for medical library of 100,000 vols., 250 readers.

References appear on following page.

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

GENERAL SPACE ALLOCATION

SPECIAL/TECHNICAL LIBRARIES

1. Metcalf, Keyes D. Spatial requirements and estimated project cost for a new library building. In: Law Library Journal, 6:2 (May 1968) pp. 69-72.

2. Vedder, Marion H. Guidelines for planning a model library in a correctional institution. In: American Journal of Correction, 23:3 (May 1961) pp. 4-8.

3. American Library Association, Association of Hospital and Institutional Libraries. Standards for library services in health care institutions. A.L.A., Chicago, 1970, 25 p.

4. Neal, K.W. Technical college libraries. Author, Staffs, England, 1965, 159 p.

5. Anthony, L. J. Library planning. In: Ashworth, Wilfred; ed. Handbook of special librarianship. Aslib, London, 1967, pp. 309-61.

6. Brandon, Alfred. Management methods in libraries: a symposium on space management and layout. In: Bulletin of the Medical Library Association, 49:2 (October 1961) pp. 523-30.

Physical Requirements

Lighting Levels

This is an area in which opinion is varied and recommendations seem to be based upon subjective factors. Keyes Metcalf's new book, Library Lighting (36) brings together many of the opinions but does not resolve the issue in any satisfactory way. Because the cost of lighting installations is high and long term maintenance costs also enter into consideration, it would be very useful for planning teams to read Metcalf's book before deciding on the lighting system. While it does not give any answers it provides all the arguments revolving around library lighting requirements.

The search for quality, which may be the most important factor in lighting, reasonable prices, and satisfactory light levels for users will continue for some time. Research might resolve some of the problems but only if the work were conducted by an independent group with nothing to gain from the results. Looking to the future, electrical carpeting may provide a method of individual lighting control. A low level lighting system could cover the ceiling, with individual lighting fixtures available for each reading or work station. These fixtures could be rheostat controlled so each reader could select his own light intensity.

In view of the cost of lighting libraries, we suggest that a mock up of the lighting system could be a good investment in a large scale project. Very high light intensities should be used with caution; many of those groups recommending high levels seem to have more than reading and working needs in mind. Finally, the building program should confine itself to the quality and atmosphere desired in each area of the facility. It does not really seem appropriate for the program to specify the intensities nor how the quality or atmosphere is to be achieved. This should be left to the architect and engineers to suggest ways of accomplishing the desired level.

The recommended reflectance levels in the table on page 147 help suggest the contrast necessary between the colors or materials used for floors, ceilings, walls, etc. For example, an 80-90% reflectance factor for the ceiling would recommend that the ceiling be white.

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(36) Metcalf, Keyes D. Library lighting. Association of Research Libraries, Washington, D. C., 1970, 99 p.

PHYSICAL REQUIREMENTS

LIGHTING LEVELS

	1	2	3	4	5	6	7
FOOTCANDLES: READING ROOM	70	30-35: 70-80% of total. 60-70: remainder of area. 90-105: some of area.	70	40-60	50	50-70	55-70
OFFICES	100						
CORRIDORS, STAIRWAYS	20	15					
READING TABLES (LENDING LIBRARY)			30				
READING TABLES (REFERENCE LIBRARY)							
COUNTERS							
CLOSED BOOK STACKS							
BINDING			50		50		
CATALOGING, SORTING & STOCK ROOMS		70	70		30		
WASH ROOMS	30	15					
STACK AREAS		30-35	30				
CARD FILES			70				

References appear on following page.

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

PHYSICAL REQUIREMENTS

LIGHTING LEVELS

1. Illuminating Engineering Society. Recommended practice for Office Lighting. In: Illuminating Engineering, 55:6 (June 1960) pp. 313-44.

2. Metcalf, Keyes D., Library lighting. Association of Research Libraries, Washington, D. C., 1970, 99 p.

3. Illuminating Engineering Society. Recommended levels of illumination. (RP-15) A reprint of Figure 9-53 of the I.E.S. Lighting Handbook, Fourth ed. I.E.S., New York, 1966.

4. Baker, Marjorie O., How to start a small technical library. In: Special libraries: how to plan and equip them. SLA Monograph No. 2. Chester M. Lewis, ed. Special Library Association and Edwards Bros., Ann Arbor, Michigan, 1963.

5. Ellsworth, Ralph. Structure and materials. In: The state of the library art. Ralph R. Shaw, ed. Vol. 3,pt. 1, Building. Rutgers - the State University, Graduate School of Library Service. New Brunswick, 1969, pp. 90-92.

6. Jordan, Robert T. More light on lighting. In: Library Journal, 87:21 (1 December 1962) pp. 4326-29.

7. Mason, Ellsworth. Lighting and mechanical progress in universities. In: Library Trends, 18:2 (October 1969) pp. 246-61.

PHYSICAL REQUIREMENTS

REFLECTANCE FACTORS

	1	2
CEILING	80-92%	85%
WALL	40-60%	60%
FLOOR	21-39%	30%
FURNITURE & BOOK SHELVES	26-44%	35%
DESKS, TABLE TOPS, COUNTERS		40%
RECOMMENDED BRIGHTNESS RATIOS: TASK & ADJACENT SURROUNDINGS	1 to 1/3	
TASK & REMOTE DARKER SURFACES	1 to 1/10	
TASK & REMOTE LIGHTER SURFACES	1 to 10	
LUMINARES & ADJACENT SURFACES	20 to 1	
ANYWHERE IN FIELD OF NORMAL VIEW	40 to 1	
RATIO OF MAX TO AVERAGE BRIGHTNESS		

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

1. Illuminating Engineering Society. Recommended practice for office lighting. In: Illuminating Engineering, 55:6 (June 1960) pp. 313-44.

2. Zahour, Robert. Library lighting. In: Guidelines for library planners. Proceedings of the Library Buildings and Equipment Institute, College Park, Md., 18-20 June 1959. A.L.A., Chicago, 1960, pp. 26-27.

Floor Coverings

Floor coverings seem to generate a great deal of debate. Everyone involved in the planning process is likely to have an opinion about what type of floor covering should be employed. Differing opinions are found among all groups participating in the planning process: libraries, architects, consultants, and administrators. Perhaps the most consistent group is the administrators who tend to favor a resilient tile covering as opposed to carpeting. The opposition is generally based upon the initial cost of carpeting.

Frequently there are attempts to justify carpeting on the grounds that its maintenance costs are lower, making it less expensive in the long run. There are many factors involved in the evaluation of the cost figures and a considerable difference of opinion as to the validity of the various test results. Several of the cost calculations have been based upon commercial installations; few libraries have the funds to support a commercial maintenance program.

A thorough study on the economics of the question, done by researchers at the Wharton School of Finance and Commerce, found that resilient flooring was at all times more economical than carpet. (37) Their report, however, recognized that in spite of higher cost there are compelling reasons for using carpet.

Acoustical quality is perhaps the most important, although it is extremely difficult to measure benefits gained by the users and the staff as a result of the noise control. Another factor is comfort for public service personnel who spend a large part of their day on their feet. Staff attitude is very important in providing good service and intangibles like carpeting help keep good attitudes toward the job.

One attempt to measure the psychological value of acoustical carpeting to staff personnel was sponsored by Educational Facilities Laboratories. A teacher opinion poll was designed to assess the quality of the teaching environment by those who actually use it. From results such as the example quoted below, the study concluded that acoustically absorptive floor coverings seemed to add desirable acoustical improvement by reducing traffic noise, the scuffling of feet, the scraping of furniture and other floor-created noises.

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(37) Parks, George M. A summary: the economics of carpeting and resilient flooring: an evaluation and comparison. University of Pennsylvania, Wharton School of Finance and Commerce, Industrial Research Unit, Philadelphia, 1966, p. 10.

> "Significantly, one school on the East coast had large areas both uncarpeted and carpeted. In the uncarpeted section the majority of the opinions rated the rooms as satisfactory, but in the carpeted portion the teacher opinion was changed to a majority assessing the rooms as good. In the first case 83% of the faculty were divided between acceptable and satisfactory, and in the second case 85% rated the rooms good to excellent." (38)

The most difficult factor to weigh and yet a very important one is the atmosphere created by carpeting which is unmatched by any of the other floor coverings. This factor may be more important than any of the others in the long run. By making the library an attractive, warm place to work, the services and information resources may be more fully utilized. No matter how good the collection may be,if it is not used it is of no value and one way to help increase the use is to make the library a pleasant place in which to work.

The entire question of carpeting ought to be explored at length. Cost and maintenance have been examined but the other factors have not been examined in detail. A number of experiments ought to be conducted relating to noise control, comfort and atmosphere. When those experiments are finished perhaps the question of carpeting in libraries will no longer be a matter of debate and subjective opinion.

Ceiling Heights

In the past library planners strongly felt that reading rooms and work areas had to have very high ceilings. One reason for this was the need for air circulation and light; however, developing technology has taken care of these needs. Libraries continued using high ceilings long after the physical necessity for them had passed. Low ceilings were assumed to create a feeling of oppression during long term use, especially in large open spaces.

As can be seen from the table on page 150, there is more than a 2 foot difference between the highest and lowest recommendations for reading areas. Ceiling height for reading areas would seem to be independent of such factors as whether the user is an Army technician, a college student, or an adult reading recreational material in the public library. Note that one of the highest ceiling height recommendations appears in the Army regulations while a leading building consultant suggests the ceiling could be more than two

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(38) Fitzroy, Dariel; Reid, John Lyon. Acoustical environment of school buildings. EFL Technical Report no. 1, New York, 1963, p. 25.

PHYSICAL REQUIREMENTS

CEILING HEIGHTS

	1	2	3	4	5	6	7
RECOMMENDED CEILING HEIGHTS	As low as 7'8" in reading areas up to 25 x 54 feet	8'-8'6"	9' up to 15' for rooms over 40 x 80'	As low as 7'2"-7'6" for stack areas 8' 6" in reading room	At least 9'	8'6"	9'-10'

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

1. Metcalf, Keyes D. Special problems in university libraries. In: Library Trends, 2:4 (April 1954) pp. 554-61.

2. Holdsworth, Harold. Library planning: open and closed access systems. In: Architects Journal, 141:9 (3 March 1965) pp. 545-47.

3. Cowgill, Clinton H.; Pettengill, George E. The library building. (Pt. 1) In: American Institute of Architects Journal, 31:2 (May 1959) pp. 55-66.

4. Ellsworth, Ralph. Planning the college and university library building. Pruett Press, Boulder, Colo., 1960, 102 p.

5. Falgione, Joseph. Survey of public library building projects in Pennsylvania, 1960-67. In: Pennsylvania Libraries Association Bulletin, 23:1 (August 1967) pp. 59-63.

6. Beder, Robert M. Structural requirements of library buildings. In: Special libraries: how to plan and equip them. SLA Monograph no. 2. Chester M. Lewis, ed. Special Libraries Association and Edwards Bros., Ann Arbor, Michigan, 1963, pp. 8-11.

7. TM 5-843-1. Space and planning criteria for U. S. Army service schools. 8 July 1970.

feet lower. Is there a "correct" height? This can only be answered on the basis of tests for each type of activity and the team could consider several ceiling heights.

Since there is no tested standard for use at the present time some medium figure should probably be employed. Using eight feet six inches as the norm the planning team should be safe and may also save a little money. It seems likely that tests will not show a lower ceiling height to be detrimental, at least in smaller areas.

Security

All libraries are confronted with several types of security problems; one type is primarily the concern of military and certain Federal libraries (classified information and documents).* Because of user requirements, security must be looked at in terms of personnel safety and document safety.

Fire protection is a concern in all libraries. The facility must be highly fire resistant throughout and in some areas fire proof (special and rare book collection areas) for a considerable period of time. Users must also be given ample fire escape exits.

At the same time the library must have control over the collection and still protect the building occupants. From an administrative, operating, cost, and security of collections point of view, a single entrance and control point would be ideal. However, in any large facility a single entrance/exit would place some staff members and/or patrons a distance far beyond any considered safe by safety officals. A compromise must be made in almost all cases and additional exits installed. The library must then find a method of controlling these exits as inexpensively as possible. There are a number of systems available for installation on fire exit doors which allow the use of the door in an emergency but which also trigger an alarm. While these systems do not keep people from taking materials out, they do provide some alarm that the door has been used. To date no system is available that completely satisfies both fire and collection security needs.

An example of this problem was recently encountered by the library at the Naval Postgraduate School at Monterey, California. In this case the difficulty involved classified documents, a security consideration common to military and some Federal libraries. The new library at NPS has a large classified documents vault also containing a staff working area and user stations. For document security reasons only one entrance to the vault was planned. Fire officials insisted two exits be provided. After several weeks of discussions with fire and safety officials, the issue was resolved by re-designing the use of space in the vault to move all the reading and work stations within the distance required by safety considerations. The working conditions will be a little crowded because of this fact, but some adjustment had to be made to balance the safety of people vs. materials. For a discussion of vault requirements (housing classified materials) see page 63.

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* This is also discussed in Section A.

Librarians and consultants almost universally agree that sprinkler systems should not be installed in a library. Water from such a system will probably cause more damage than the fire it puts out. Smoke and heat detection systems are available and are very adequate for library fire protection needs. The absence of a sprinkler system only causes problems when the library wishes to buy fire insurance.

At the present time there appears to be very little research that can be done in regard to fire security. The main conflict is people versus materials and it seems likely this issue will remain unresolved for some time. Perhaps the utilization of slide fire escapes for multiple story buildings might help; however, most libraries (and those with the greatest difficulty) are one floor facilities where slide type systems would be of little value.

The entire question of general collection security is an area of concern. Most of the existing systems, electronic or manual, have few implications for the physical facility except they should be included in the planning. None of the systems are fool proof and anyone planning to install one of the expensive electronic systems ought to see it demonstrated and talk with some of its users before making a commitment.

Access For The Handicapped

Although very few Army technical libraries will have patrons who are physically handicapped, it seems appropriate to list a few of the major factors in making a facility accessible to such persons. As there is an increasing pressure to employ handicapped persons it is certainly possible that Army technical libraries may have either patrons or staff members who are handicapped. This is especially true with the number of disabled veterans returning to the work force. In many cases a facility made accessible to the handicapped is easier for non-handicapped persons to operate.

> "Where there is additional cost attributed to designing and planning for the physically handicapped . . . it is small and more than offset by the fulfillment of personal potential

> and contribution to society by persons who although handicapped, become skillful, productive members of their community." (39)

By incorporating some of the basic features listed below the facility becomes more flexible by allowing a greater number of people to use and work in the facility with some degree of ease. The number of people involved is not small--it is estimated one out of every seven people in the United States has a permanent physical disability. (40)

The President's Committee on Employment of the Physically Handicapped (references 39 and 40) has made some recommendations for making facilities accessible to the handicapped. These are summarized below:

DOORWAYS:	Depth between 2 doors (e.g. outer and inner) must be 6'6" to avoid trapping wheelchair.
THRESHOLDS:	Shape for accessibility, height no more than 3/4".
HANDLES:	No higher than 3'6".
VIEW PANELS:	Glazing should be in all swinging doors down to 3' from floor. Doors with large areas of glass should have markings to avoid accidents.
EXTERIOR STAIRWAYS:	Risers no greater than 5 3/4", and treads a minimum of 14".
ELEVATORS:	Minimum of 5'1" x 5'6", no control above 4'.

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(39) State University Construction Fund. *Making colleges and universities accessible to handicapped students*. Reprinted by President's Committee on Employment of the Handicapped, Washington, D. C. n.d.

(40) *American standard specifications for making buildings and facilities accessible to, and usable by the physically handicapped*. President's Committee on Employment of the Physically Handicapped. Washington, D. C., 1961, p. 3.

WALK:	With 5% gradient must have rest areas at maximum of 60' intervals.
RAMPS:	Rest platforms, minimum 4'6" for every 30' of ramp. When entering building, platform of minimum 5' depth extending a minimum of 1' on either side of door.
CARRELS:	1% of study carrels should be accessible to wheelchairs.
AISLES:	Minimum of 4'.
TABLES:	Minimum of 30" from floor to underside of working space.

Furniture and Equipment

Computers and Special Audio Visual Equipment

Librarians have been speculating for years about the implications of the "new" media and computers upon library physical facilities. At first, it was felt there would be a great impact on the building; today many feel there will be very little impact. This does not mean computers and new media will not play an important role in information services, but rather their impact on facilities will be more limited than expected. Space to use the equipment or media will be required; however, very few other special provisions will be necessary. On line computer capability is available through the use of consoles and telephone line hook ups. New electrical carpeting will allow use of most library power equipment at any location. At present there will be a need for coaxial cable channels for some video capabilities but this may change in the near future.

As long as Army technical libraries remain single mission libraries, it is very unlikely they will become involved in the major production and use of video materials. If there is a change to a single service point for a camp or base, then there will be a need to examine the type of production facilities now in use in many community college library media centers.

Shelving

Figures are almost standard for shelving, in part due to the way in which the shelving is manufactured. Perhaps seven foot sections are too high for many people. If possible, a six foot high section should be employed where space permits. Using a lower height will mean less damage to the materials being stored; the edges will not be pushed and dragged over the edge of the shelf by people who must stretch to reach a shelf a foot or more over head. It will also be less tiring for staff members who shelve the materials and less dangerous, since people will not have to use step stools to reach materials. All in all it is more convenient and easier to use lower stack sections. One might consider using a narrower aisle width to gain the extra stack area lost with lower sections.

Shelf depth ought to be eight inches for most book storage areas. A wide range of depth is available to handle almost any type of storage problem. Special cabinets are available for maps, microfilm, microfiche and other non-book materials. Such special equipment should be examined in the light of individual needs, expected growth rate and use of the particular material. Shelving recommendations are contained in the table on page 156.

MATERIAL STORAGE

SHELVING

	1	2	3	4
ADULTS	72" highest shelf Lowest shelf 12" above floor.	6'10" high - 8-10" deep.		
YOUNG ADULTS	66" highest shelf Lowest shelf 9" above floor.			
CHILDREN	45" highest shelf Lowest shelf 4" above floor.	5'6" high. 12" deep.		
RECORDINGS		14" deep. 13" clearance between shelves.		
MAGAZINES				
NECESSARY SHELF DEPTHS			90% of shelves 8" deep.	85% of shelves 8" deep. 15% of shelves 10-12" deep.

Primary sources should be consulted due to the possibility of variations in individual interpretation of the data.

1. McCarthy, Francis Joseph. Human mechanics in relation to equipment. In: Planning library buildings for service; Proceedings of the Library Buildings and Equipment Institute, Kent State University, 6-8 July 1961. A.L.A., Chicago, 1964, 127 p.

2. Johnson, Marion S. Placement, space, equipment. In: International Journal of Religious Education, 43:2 (October 1966) pp. 8-9.

3. Broadus, Robert N. What to look for in library shelves. In: College and University Business, 36:3 (March 1964) pp. 73-4.

4. Burke, John Emmet. Planning the functional college library. East Texas State College, Commerce, Texas, 1961, 60 p.

Furniture

There are hundreds of companies selling library furniture lines. At the same time most new major libraries have some percentage of their furniture and equipment "custom" built. Custom items range from circulation desks and book shelves to study carrels and chairs. All of these custom designed items are available from several different suppliers. No doubt part of the attraction in custom furniture lies in some element of pride and the need to have something "unique" in the new facility. More important probably is the lack of agreement and standards for determining the performance of library furniture and equipment, making it easier to request custom items.

Selecting furniture involves a range of issues which can be identified as follows:

a) who selects?
b) is it comfortable?
c) is it well made?
d) is it well designed?
e) how much does it cost?

Each question needs to be examined in depth by the planning team. In addition, definitive studies relating to design and construction of library equipment ought to be undertaken by an independent testing group. In the absence of performance specifications for library items, the planning team cannot effectively evaluate furniture and equipment.

A common complaint heard throughout government libraries, including Army technical libraries, refers to the necessity of using library equipment and furniture supplied by the General Services Administration from Federal Supply Schedules. With the wide range of items available other than GSA, many people feel the GSA schedules are very restrictive, even with the choices offered. In many cases it appears as if the only criteria for inclusion were cost and durability. These are the primary considerations; however, there are numerous examples of well designed, good looking furniture that is reasonably priced and very durable. Often for a little more money per item an interior designer is able to secure pieces as durable as any on the schedule but much more attractive.

Without a full scale testing program it is difficult to demonstrate the validity of statements heard regarding the quality of the GSA equipment and furniture. What is demonstrable is the fact that many librarians attempt to get exceptions to the use of GSA schedules and a few succeed. Why take the time and effort to avoid using GSA furniture unless experience has shown the items to be less satisfactory than could be secured from other sources?

As noted on page 37, ASPR 5102.3 30 April 1971, Rev. 9 indicates "no exceptions" are allowed to the mandatory use of the GSA Supply Schedules. However, there are some exceptions under certain circumstances. ASPR 5102.2, 30 September 1970, Rev. 8 allows for three basic types of exceptions.

"(a) Delivery Requirements

(b) Similar Items

(c) Abnormal Requirements"

Under the provisions of (a), mandatory use of the GSA material is not required if the delivery period in the Schedules does not meet the needs of purchasing office. It is also possible under the provisions of (b) to secure items similar to those on the GSA Schedules from other sources when they are needed for a "special requirement". A statement must be submitted explaining why items listed in the Schedule are not satisfactory. Exceptions are also possible according to the provisions of (c) when the quantity needed does not meet the minimum/maximum limitations provided in the Schedules.

In view of the situation, the entire question of the use of GSA Schedules must be examined. Some examples are given below of circumstances in which exceptions to the use of GSA material might be requested.

GSA furniture appears to emphasize cost and construction over the other issues. A "standard" GSA circulation module, for example, may be durable and inexpensive but it may not be designed for the comfort of the people using the unit, or it may not have been chosen to look well with the other equipment.

Libraries required to furnish a predetermined space with GSA furniture, may find it difficult to secure the right size equipment. For example, there may be a need to locate six desks in a small room. Standard GSA desks might cut down significantly the space available for moving book trucks, equipment and people. Smaller desks, secured from non-GSA sources, might allow for more room. Using GSA equipment with non-GSA equipment might lead to more problems due to differences in height, width, etc. It would seem simpler to have the freedom to choose the required equipment without regard to source, and thus achieve a more efficient operation. As noted earlier, what may seem to be a minor inconvenience in an abstract planning situation may, over the life use of the equipment and facility, cost considerably more than savings achieved through mass buying power.

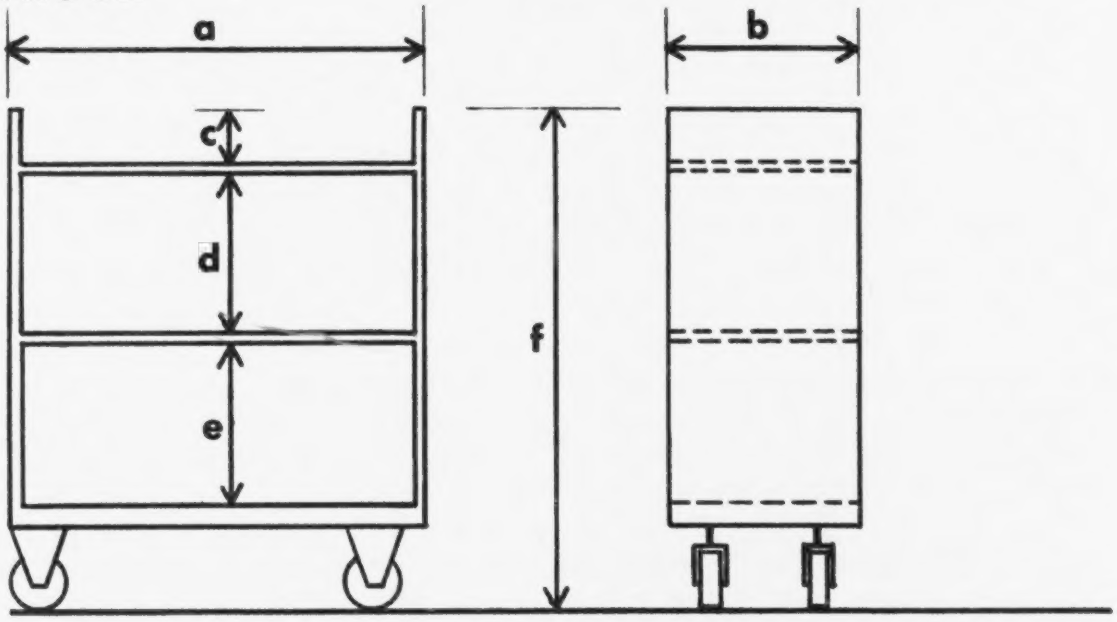
The table on page 160 shows one type of GSA library furniture and some of the variations that can be found in other suppliers' catalogs. In this case the planning team will have to draw its own conclusions based upon comparisons since there is no information on the durability of the various items.

Furniture selection is a part of the question of providing the proper environment for the various activities of the library. The success of a library is partially dependent on the interraction between the user and the environment. As noted on pages 125and 15, further studies ought to be undertaken to explore the relationship between different environments and specific library activities. These studies would, in turn, relate to the psychological impact of the total facility on the user. Throughout Section B we have commented upon the need to study the activity and environment to determine space needs rather than fitting an activity into the sapce available. In order to develop a sound basis for calculating the space needs a series of studies should be undertaken on the user, the environment, and the activity.

Since the furniture and equipment is an integral part of this problem it would seem wiser to start with the widest possible base for selection, rather than confining the search to GSA schedules. The use of GSA equipment would in part predetermine some of the space considerations. In view of the need to study the total environment, including furniture and equipment, we feel the use of mandatory GSA material must be carefully examined.

COMPARATIVE FURNITURE DIMENSIONS

BOOK TRUCK



type	a	b	c	d	e	f	remarks
GSA	30	14	min 4	min 11-1/2	min 11-1/2	V	height varies
NON-GSA EQUAL	28	13				41-1/2	minimum
	39	18				40	maximum
ALTERNATES	30	17				40	sloped shelves
	22	22				32	depressible bin

SUMMARY B

In this section we have briefly discussed the currrent state of the art in planning and designing non-Army libraries. The rationale for this section in this report is that basically there is very little relevant material available dealing specifically with Army technical libraries. It also provides a solid basis for determining areas in which to concentrate work in Phase II.

On the basis of our review of the design process for non-Army libraries, we draw the following conclusions listed under the headings used in the body of the report:

INTERPRETATION

1. Employ a carefully selected and well managed planning team bringing all principal members in at the beginning.
2. Establish from the beginning an easy and mutually comprehensible flow of communications.
3. Explore all alternatives to housing the new facility from existing space to newly constructed space.
4. Develop a well constructed building program in close consultation with everyone involved.
5. Be careful to take change over time into account not only as applied to the collection but also to the community and institutions served.
6. Review as many design alternatives as possible before making the final selection, involving in the review as many of those who will be using the facility or paying for it as feasible.

IMPLEMENTATION

1. There are so many variations in current practice in the civilian sphere there is little point in attempting to summarize the data.
2. Because of the variation in current implementation practices, Army technical libraries could gain very little from a review of these practices.

EVALUATION

1) There are some subjective, qualitative evaluation methods in use for libraries but they tend to be hit and miss in their application.

2) There are few quantitative, objective techniques available for use in evaluating libraries.

3) The basic evaluation processes are generic in nature and could be applied to all types of facilities, including libraries, with very little modification.

4) The evaluation process should be, but is not, part of the entire planning and design process.

5) The use of pre-construction evaluation of plans on an objective basis could help avoid some of the problems encountered after construction has started.

6) There is a great need to perform post-construction evaluation of expectations versus actual results in order to improve the planning and design process the next time.

DATA COLLECTION

1) The sources of recommendations on specific items are varied; it is very difficult to evaluate the validity of many of the sources.

2) The specificity of the recommendations varies and quantification is no assurance the problem is understood or that the data are accurate.

3) The basis for making the recommendations is seldom a carefully developed tested program, but is usually a matter of experience and opinion.

4) There is a need to examine carefully all of the data used in the planning process and when necessary set-up procedures to determine their validity.

Recommendations for Interim Use

1) Employ a team planning approach in developing a new facility.

2) Produce a detailed written program.

3) Examine all alternatives for achieving the desired space, with a full documentation of the costs, advantages and disadvantages of each alternative.

4) The functional analysis of the intended flow of materials, information and users; the compilation of a matrix of proximity relationships for all functional areas; the establishment of space standards for all library activities; the clear graphic display of all building spaces; and finally the manipulation of these by the client-team until satisfactory interrelationships both vertical and horizontal are achieved, are recommended procedures to arrive at satisfactory design.

5) The use of a checklist of the elements of worth in the evaluation process helps in the development of sound design.

6) The use of the generic evaluation method, as described on pages 116-18, throughout the design process will improve the chances of achieving a good vacility.

7) Throughout the discussion on data collection, recommendations have been made; in particular see pages 126,129 , 134,137 , 141, 144, and 151.

SECTION C

IMPLICATIONS FOR FUTURE LIBRARY PLANNING AND DESIGN

IMPLICATIONS C

In this section are indicated some of the directions library planning and design may take in the future. Some of the discussions are highly speculative. Other discussions indicate ideas and practices which are presently available, but which have not been widely used in the construction industry and have not been applied to any library building project.

A GENERIC PLANNING SYSTEM

At several points in this report it has been indicated that there is a fundamental similarity in the physical facilities for all types of libraries. This similarity is considered to be so strong that a generic basis can be developed for any library facilities planning process. This generic planning system when fully developed, as is proposed for Phase II, can become the basic planning tool regardless of type of library. Furthermore, any organization primarily concerned with the process of information transfer (information center, information analysis center, media center) could use the system with little or no modification.

In order to plan an effective physical facility, the planning team must understand all of the functions performed and accommodated. The system proposed for development, the outline of which is discussed below, would be designed to accomplish the following tasks:

1) Provide non-librarian members of the planning team with a concise but comprehensive outline of what libraries do.

2) Provide librarian members of the planning team with a comprehensive list of the activities involved in each function. Thus they can choose from a range of alternatives, rather than simply repeat local practice without realizing how many alternatives are available.

3) Provide a systematic format for the analysis of needs.

4) Provide a means of interpreting the requirements of each activity into physical form.

5) Provide a means of quickly determining the interrelationships between activities in alternative configurations.

6) Provide a recorded framework as a basis for evaluation at any stage in the design, construction or post-occupancy periods.

There follows a description of the overall outline of the proposed system. One function is described in some detail for each level of the system and an example is given to show how the system might be used to analyze and evaluate plans. Examples are given to show how the proposed system could be employed to analyze interrelationships, and how it would translate a group of activities (identified as taking place in the library) into a statement of physical facility requirements.

Model of the Information Transfer Process

The explanation and consideration of all functions that are included in the transfer of information is critical in the context of our concern for developing adequate physical facilities. If these basic library services can be analyzed and abstracted into generic concepts, applicable to all libraries regardless of type and size, then the probability increases of creating a logical and comprehensive basic guide to planning library space requirements.

All information transfer operations within a library proceed through a series of stages to accomplish each basic objective. It appears that every increment in the process may be predictable in any library, information center, library resources center or other similar unit. The entire complex process of transferring information is considered within a series of levels. As one considers each level in turn, selecting and rejecting options and alternatives, a particular library pattern ultimately emerges (academic, public, school or special/technical).

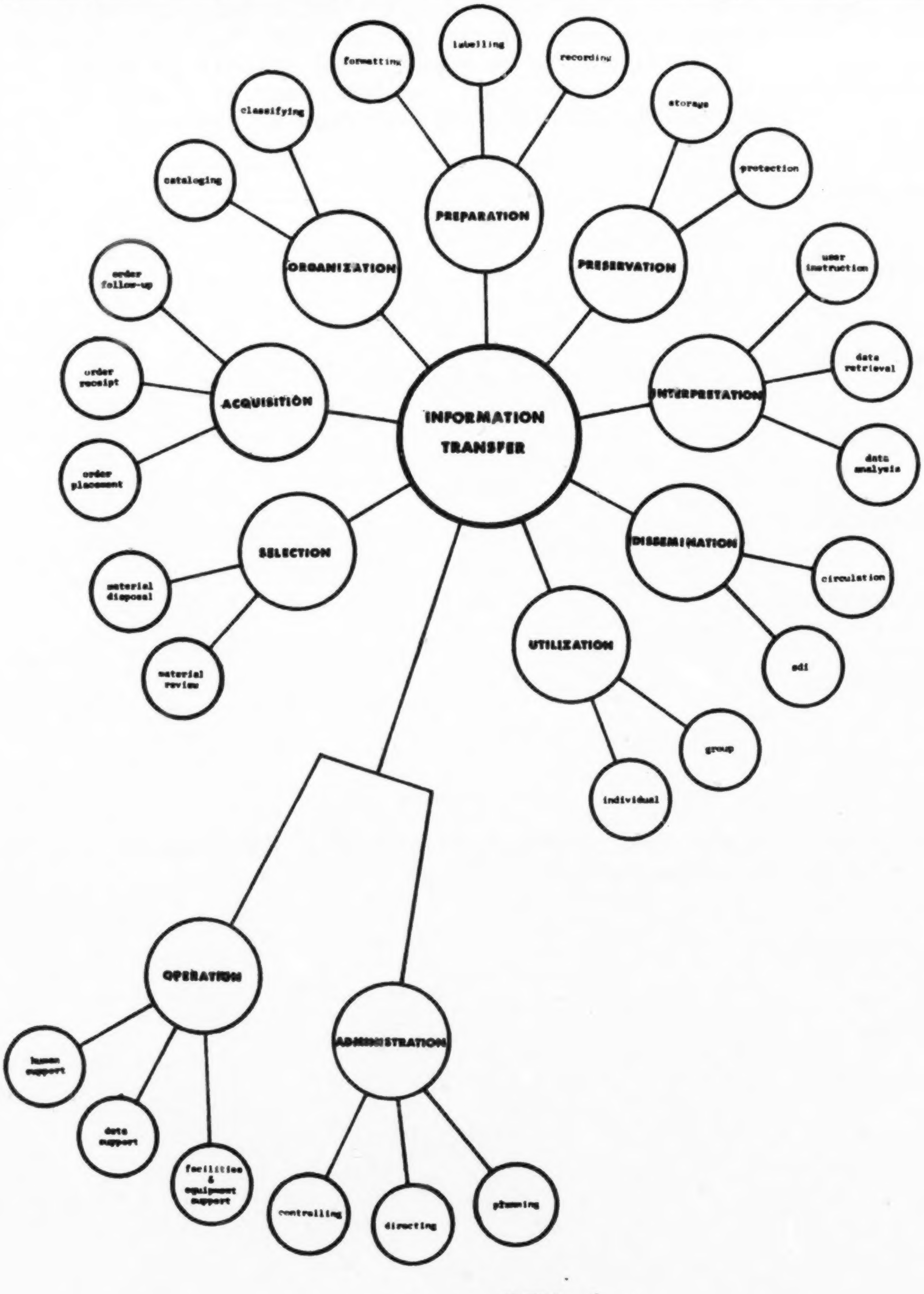
In order to describe the levels of the process in generic terms, definitions of each that are appropriate to all organizations concerned with transferring information are offered as follows:

Level I - Functions
Level II - Sets of sub-functions within each function
Level III - Elements within each set or sub-function
Level IV - Components within each element
Level V - Activities within each component

The diagram on page 167 illustrates the first two levels (I and II) of the model.

INFORMATION TRANSFER

MODEL OF PROCESS


formatting
labelling
recording
classifying
storage
cataloging
protection
PREPARATION
ORGANIZATION
PRESERVATION
user instruction
order follow-up
data retrieval
order receipt
ACQUISITION
INFORMATION TRANSFER
INTERPRETATION
data analysis
order placement
SELECTION
DISSEMINATION
circulation
material disposal
UTILIZATION
sdi
material review
group
individual
OPERATION
ADMINISTRATION
human support
data support
facilities & equipment support
controlling
directing
planning

Definitions of Functions in the Information Transfer Process

Transfer of information is accomplished only after a number of rather complex activities are carried out. While many definitions for these activities have been advanced, most have been in terms of a specific type of operation, thus making it difficult to apply the definitions broadly. We suggest the following as a general model of the functions in the information transfer process:

SELECTION
↓
ACQUISITION
↓
ORGANIZATION
↓
PREPARATION
↓
PRESERVATION
↓
INTERPRETATION
↓
DISSEMINATION
↓
UTILIZATION

In order to carry out the functions effectively, two support functions must exist in the organization:

ADMINISTRATION

OPERATION

SELECTION involves the procedures concerned with determining which data are to be included and retained in the information system. There are two sets or sub-functions incorporated in the selection function: material review and material disposal. Material review is concerned with examining data, or references to data, for their suitability for inclusion in the system. Material disposal involves the examination and evaluation of data already in the system to decide whether to retain it or, when necessary, arrange for its disposal. No matter what type of information system, large or small, simple or complex, there must be a selection process. No system attempts to acquire all data, nor can any system afford to retain all data acquired.

ACQUISITION is the process of securing the selected data for inclusion in the system. Within this function there are three sets or sub-functions: order placement, order follow-up, and order receipt. Order placement is concerned with setting up procedures for securing the required items. This may be a business procedure or a request for material; it may involve a procedure established to avoid the acquisition of duplicates. The order follow-up set or sub-function deals with the problems of maintaining records of orders, maintaining procedures to check on items not received, and clearing records after receipt of the ordered material. Order receipt covers the procedures employed to handle materials after they are received. Again there is a very wide spectrum of possible procedures, which may also involve accounting procedures and issuing checks; it may be recording the fact that a specific item has been received; and it includes the routine matters of how to deal with the handling of the data as it arrives, no matter in what form. As with the selection function, all information systems, from the simplest to the most complex, must employ the acquisition function and some aspect of each set or sub-function.

ORGANIZATION is the process by which the information system attempts to handle the problem of identifying a specific item of information contained in the system. Within this function there are two sets or sub-functions: cataloging and classifying. If one defines both sets or sub-functions in a generic manner, rather than using the more narrow library science definitions, then the two terms become comprehensible. If broad definitions for these words are not acceptable, then new terms will have to be found to describe the activities they include. Cataloging can be defined as the process of systematically describing, according to specific rules, the physical and subject characteristics of the data acquired. Classifying is the process of assigning each item to one or more locations in a taxonomic system. Usually the taxonomic system attempts to group items on the same subject. Both sets or sub-functions may make use of rules of description and of classification which are widely used in organizations concerned with information transfer, or they may employ a set of unique rules of cataloging and classifying. Whatever approach is taken, common, unique, or some combination, all artificial information systems appear to engage in both sets or sub-functions to some degree.

PREPARATION is the function covering the process of physically treating the data for inclusion in the system. This function may be divided into three sets or sub-functions: formating, labelling, and recording. Formating is the process of changing the form of the data when necessary to conform to the requirements of the system's storage procedures. This process may involve such activities as combining or separating data groups, changing the medium carrying the data, or applying protective coverings to data. The process may or may not be carried out on all the data the system acquires. Most systems engage in this activity to some degree, although many acquire only a very small percentage of data requiring reformating. Labelling is the process of producing and applying identification symbols to the data. To be able to retrieve the data from the system, tags of some type must be employed. Recording is the process of generating a surrogate file of data. This file serves as a compact means of access to the data in the system. Normally surrogate files allow the user to identify the presence or absence of a specific item on some topic, based upon a brief description, and describe how to retreive the item. Every information system must make some provision for these processes.

PRESERVATION is the function concerned with protecting and storing the data for future use. There are two sets or sub-functions within this function: storage and protection. Storage has some element of protection within it but the primary purpose of storage is to hold the data until such time as it is needed. The process involves the physical placement of the data in a location from which it may be retrieved. Part of the storage sub-function is ensuring that appropriate conditions exist for access. If the data are stored under inappropriate access conditions, in time the system will fail, because data will be lost, time delays in retrieval will be too long, and/or the user(s) will become dissatisfied. Protection, on the other hand, is concerned with the security of the data. Procedures within this sub-function deal with the problems of ensuring the data will be in usable condition whenever they are needed, and may, in some instances, also involve controlling access, so that only authorized users utilize the data. The storage period can vary from fractions of a second to hundreds of years. Whatever the period of time, all information transfer systems engage in the storage sub-function, and all systems provide some protection mechanisms to ensure the data will be available at a later time.

INTERPRETATION is the function which includes the sets or sub-functions concerned with explaining how the system works, providing data in response to an inquiry, and analyzing and manipulating the data in the system to produce new data. The three sets or sub-functions are, therefore: user instruction, data retrieval, and data analysis. User instruction, as the term implies, sets-up procedures to guide users to the most efficient methods of utilizing the system. All artificial information systems require some explanation of how they operate before a first time user can employ them.

Data retrieval procedures are set-up to respond to requests for aid and/or information drawing on unanalyzed data. The retrieval procedures involve a great deal of interpretation. Each inquiry must be examined and then the data reviewed for potentially relevant data. In this process the data is usually provided in an unanalyzed form, and it is the inquirer's responsibility to determine the relevance and analyze the data. Data analysis procedures are used to examine the data in the system in order to solve a specific problem and thus produce new data. Analysis may be undertaken either in response to inquiry, or in anticipation of an inquiry. All 'artificial' information systems engage in all of these sub-functions to some degree. Emphasis may vary, but the sets are always present.

DISSEMINATION procedures make it possible to use the data either in the system or outside the system. Many users prefer to work with the data outside the confines of the system, therefore most information systems make provisions for such utilization. There are two sets or sub-functions within dissemination: circulation and selective dissemination of information (SDI). Circulation procedures allow users to select specific data from the system and use it elsewhere. These procedures are designed to handle on-demand dissemination situations. Selective dissemination of information (SDI) is the active distribution of data before the user makes a request. Frequently the SDI data is the result of the data analysis activities which took place in the interpretation phase. In the circulation sub-function the system waits for the user to make a request; in SDI the system goes to the user with data. All systems engage in some form of dissemination, although the amount of SDI may be very limited in some.

UTILIZATION provides the space, equipment, and mechanisms that allow for the interaction between the users and the data in the system. Provisions are usually made for two types of utilization: individual and group. All systems make some provision for individual use of the data, and many provide for groups of users to work together, or singularly, but employing the same data at the same time. As implied in the definition, this function is primarily concerned with the physical aspect of the information transfer process.

These eight functions represent a proposal for a comprehensive list of generic functions which are common to all information transfer processes. Each function relates to the other functions, and each is essential to the successful operation of the entire process. However, in order to ensure the proper execution of the various functions, two supplementary functions must be considered. These two functions are administration and operation. They are not an integral part of the information transfer process and are therefore considered to be support functions.

ADMINISTRATION manages the entire information transfer operation.

Acting as the 'governor' of the main functions, it attempts to ensure the proper performance of the system by means of three sets or sub-functions: planning, directing, and controlling. Planning is the procedure employed to determine methods of performance prior to implementation. Without careful planning the system cannot perform effectively because it will make innumerable false starts. Directing is the sub-function which supervises the implementation of plans and performance of the system, and so ensures the proper sequencing of the various procedures developed for each function in the information transfer process. Controlling is primarily concerned with evaluating and, when necessary, making corrections in the performance of the system. Administrative activities take place in all organizations, and, normally, the more carefully they are carried out, the more successful is the organization.

OPERATION functions are primarily concerned with the support or maintenance of the system. They involve the operation of supporting services for the system. Normally they must handle three types of support problems: human, data, and facilities/equipment. All three categories have environmental needs, and these needs may not all be compatible. Also it may not be possible to separate the incompatible elements and still have an effective information transfer system. The operations activities must find ways to make the interface possible with as little harm as possible to each. Some operation activities deal with the vertical and horizontal movement of people and data. Maintenance of the equipment and facilities is another major sub-function. All artificial information systems must deal with some of the support/maintenance problems.

Analysis of a Function: Acquisitions

To illustrate all the levels of the information process within the proposed structure, one function has been isolated for detailed analysis. As our example, the function of acquisitions has been chosen. The diagram on page 174 presents the function of acquisitions carried through Level V - activities. Referring back to page 167 one notices that the function of acquisitions occurs in the sequence after the function, selection. One of the first decisions in the information transfer process is whether or not to acquire a specific item. This decision, in turn, ordinarily depends upon two factors: the funds available and the areas of a collection in need of development, which, in turn, depend subsequently upon the objectives of the agency being served.

As a set or sub-function within the acquisitions function, order placement is the first consideration. Elements within the set include the need to establish the existence of material, to determine whether it is in or out of the collection. A librarian usually checks to determine the availability of a book. If it is available, the checking takes place in order to verify all bibliographical notations of a title.

Within these procedures, described by various components, if no data is unearthed negating the original request, an order is usually placed.

At this point, various activities occur within each component. A dealer must be chosen and the order prepared and placed, usually according to strict business practices of the parent organization. Upon receipt of the title, which is another procedure within the function, certain elements of receiving/billing are of concern, as well as any post-cataloging. In the separate procedures of receiving and billing, the activities include everything from sorting shipments and unpacking books to preparing receiving reports, and from preparing invoices for payment to expending the funds themselves.

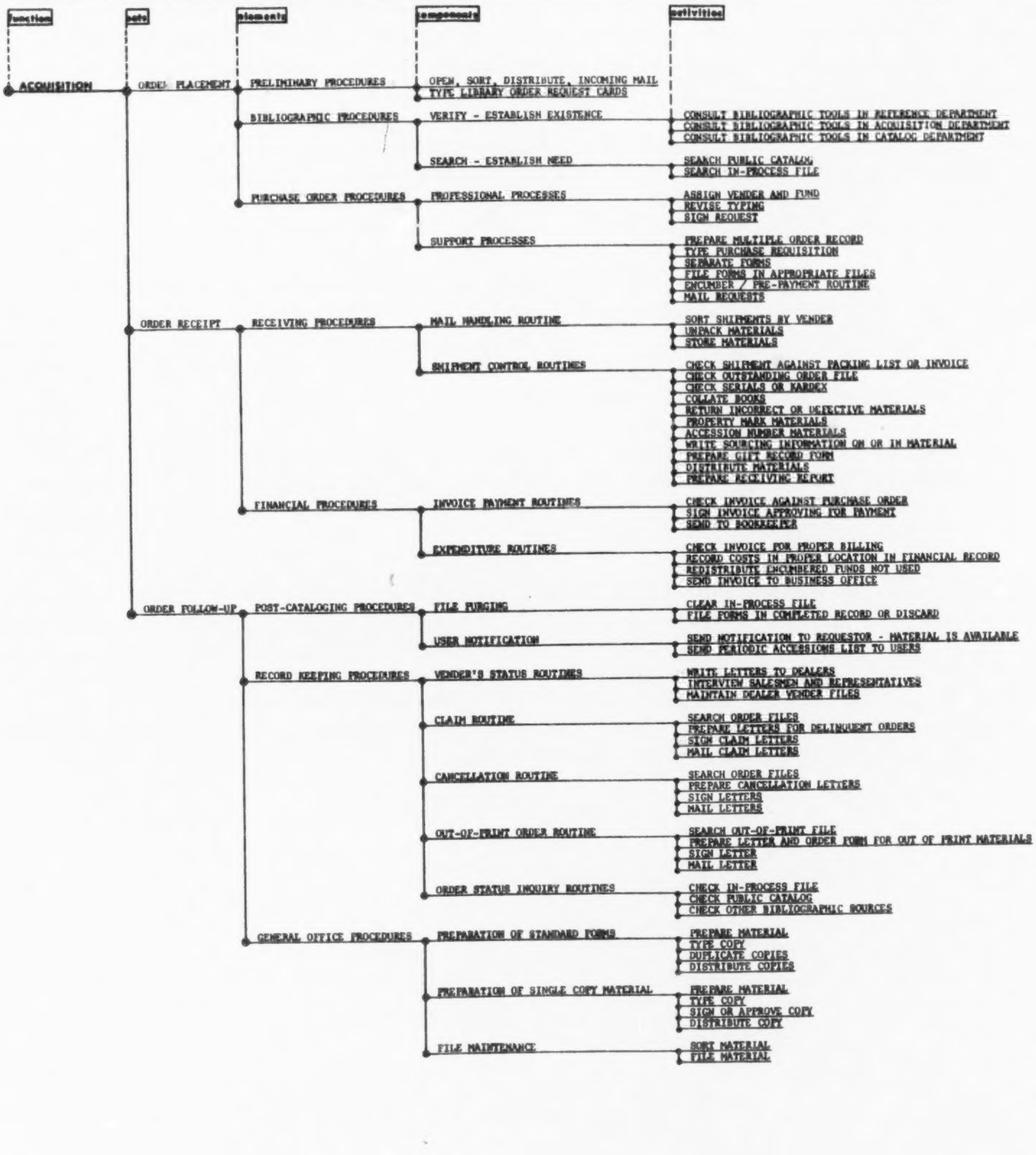
In the order follow-up set, various components are important, including the routines of determining the vendor status, claiming, cancelling, and making inquiries. Within these components, several activities transpire, such as checking and searching of order files, and receiving and preparing inquiries.

In the post-cataloging element, the file purging and notification components are considered, as well as their respective activities of clearing files and records, and sending book receipt notices and/or accession lists.

It should be noted the activities listed represent only one method of satisfying the requirements of the components. When the system is fully developed, it will include as many alternative ways of performing the requirements of a component as can be established on the basis of current practice. The purpose of listing all the activities is to provide as broad a base as possible for appropriate selection in the decision making process.

HIERARCHY OF ACTIVITIES WITHIN FUNCTIONS

HIERARCHY OF ACTIVITIES WITHIN FUNCTIONS


function
sets
elements
components
activities
ACQUISITION
ORDER PLACEMENT
PRELIMINARY PROCEDURES
OPEN, SORT, DISTRIBUTE, INCOMING MAIL
TYPE LIBRARY ORDER REQUEST CARDS
BIBLIOGRAPHIC PROCEDURES
VERIFY - ESTABLISH EXISTENCE
CONSULT BIBLIOGRAPHIC TOOLS IN REFERENCE DEPARTMENT
CONSULT BIBLIOGRAPHIC TOOLS IN ACQUISITION DEPARTMENT
CONSULT BIBLIOGRAPHIC TOOLS IN CATALOG DEPARTMENT
SEARCH - ESTABLISH NEED
SEARCH PUBLIC CATALOG
SEARCH IN-PROCESS FILE
PURCHASE ORDER PROCEDURES
PROFESSIONAL PROCESSES
ASSIGN VENDER AND FUND
REVISE TYPING
SIGN REQUEST
SUPPORT PROCESSES
PREPARE MULTIPLE ORDER RECORD
TYPE PURCHASE REQUISITION
SEPARATE FORMS
FILE FORMS IN APPROPRIATE FILES
ENCUMBER / PRE-PAYMENT ROUTINE
MAIL REQUESTS
ORDER RECEIPT
RECEIVING PROCEDURES
MAIL HANDLING ROUTINE
SORT SHIPMENTS BY VENDER
UNPACK MATERIALS
STORE MATERIALS
SHIPMENT CONTROL ROUTINES
CHECK SHIPMENT AGAINST PACKING LIST OR INVOICE
CHECK OUTSTANDING ORDER FILE
CHECK SERIALS OR KARDEX
COLLATE BOOKS
RETURN INCORRECT OR DEFECTIVE MATERIALS
PROPERTY MARK MATERIALS
ACCESSION NUMBER MATERIALS
WRITE SOURCING INFORMATION ON OR IN MATERIAL
PREPARE GIFT RECORD FORM
DISTRIBUTE MATERIALS
PREPARE RECEIVING REPORT
FINANCIAL PROCEDURES
INVOICE PAYMENT ROUTINES
CHECK INVOICE AGAINST PURCHASE ORDER
SIGN INVOICE APPROVING FOR PAYMENT
SEND TO BOOKKEEPER
EXPENDITURE ROUTINES
CHECK INVOICE FOR PROPER BILLING
RECORD COSTS IN PROPER LOCATION IN FINANCIAL RECORD
REDISTRIBUTE ENCUMBERED FUNDS NOT USED
SEND INVOICE TO BUSINESS OFFICE
ORDER FOLLOW-UP
POST-CATALOGING PROCEDURES
FILE PURGING
CLEAR IN-PROCESS FILE
FILE FORMS IN COMPLETED RECORD OR DISCARD
USER NOTIFICATION
SEND NOTIFICATION TO REQUESTOR - MATERIAL IS AVAILABLE
SEND PERIODIC ACCESSIONS LIST TO USERS
RECORD KEEPING PROCEDURES
VENDER'S STATUS ROUTINES
WRITE LETTERS TO DEALERS
INTERVIEW SALESMEN AND REPRESENTATIVES
MAINTAIN DEALER VENDER FILES
CLAIM ROUTINE
SEARCH ORDER FILES
PREPARE LETTERS FOR DELINQUENT ORDERS
SIGN CLAIM LETTERS
MAIL CLAIM LETTERS
CANCELLATION ROUTINE
SEARCH ORDER FILES
PREPARE CANCELLATION LETTERS
SIGN LETTERS
MAIL LETTERS
OUT-OF-PRINT ORDER ROUTINE
SEARCH OUT-OF-PRINT FILE
PREPARE LETTER AND ORDER FORM FOR OUT OF PRINT MATERIALS
SIGN LETTER
MAIL LETTER
ORDER STATUS INQUIRY ROUTINES
CHECK IN-PROCESS FILE
CHECK PUBLIC CATALOG
CHECK OTHER BIBLIOGRAPHIC SOURCES
GENERAL OFFICE PROCEDURES
PREPARATION OF STANDARD FORMS
PREPARE MATERIAL
TYPE COPY
DUPLICATE COPIES
DISTRIBUTE COPIES
PREPARATION OF SINGLE COPY MATERIAL
PREPARE MATERIAL
TYPE COPY
SIGN OR APPROVE COPY
DISTRIBUTE COPY
FILE MAINTENANCE
SORT MATERIAL
FILE MATERIAL

Using the System to Determine Physical Facility Needs

First, consideration is given to the nature of the relationships between functions and sets or sub-functions from various points of view. These relationships differ according to whether they are being considered from the point of view of the user, the material or the staff.

It is obvious that different design strategies could be adopted, according to the librarian's determination of the priority of one point of view over the others. Alternatively, if no single point of view has obvious priority, some compromise has to be reached between the apparently conflicting sets of relationships. The identification of this total situation, at the very outset of the design decision process, requires each member of the design team to articulate more fully the many issues involved. The ultimate decision reached, and its reasons, are recorded and will be available as a basis for any subsequent evaluation of results in relation to objectives. Once taken, these strategic decisions also enable more detailed considerations to be decided at every level of the hierarchy from function to activities.

The following group of illustrations has been assembled as an example of the use of the system in determining the needs of a proposed facility. In the diagrams only one possible set of relationships within a hypothetical library is shown. The first three diagrams (pages 177-9) show how the relationships differ when considered from different points of view. The next three interview sheets (pages 180-182) assume that a member of the design team has interviewed a Miss Smith, who participates in the following three activities (taken from the acquisitions heirarchy on page 174):

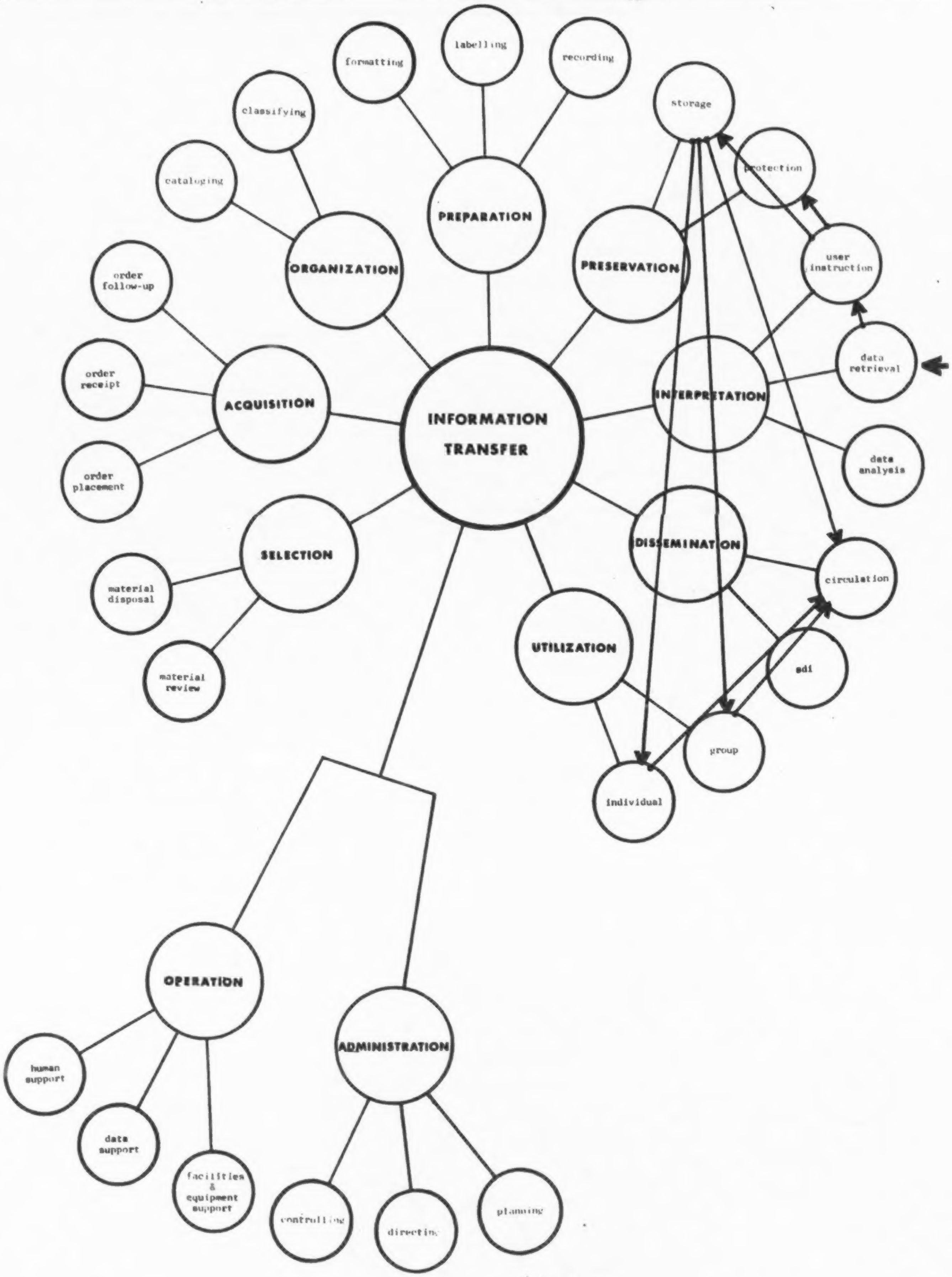
activities	-	write letters to dealer interview salesmen and representatives maintain dealer vendor files
within the component	-	vendor status routines
within the element	-	record keeping procedures
within the set	-	order follow-up
within the function	-	acquisitions

Similar records would be obtained for other persons involved and analysis of all the results would, no doubt, reveal differences as well as similarities in requirements. It would be the design team's responsibility to resolve these and determine a particular line of action.

The first interview sheet (page 180) is a simple checklist to ascertain each user's view about the nature of the task being performed, the services it requires, and the desirable environmental conditions to be achieved. From this data the interviewer would make his own expert judgement about the performance of the environmental factors, in terms of generally accepted measures as listed on the second interview sheet (page 181). On the third interview sheet (page 182) a diagram would be prepared showing a layout which describes the user's needs and preferences, which he can validate. It has been assumed here that specific GSA furniture would have to be used, this having been a guiding decision taken at a higher level. The data about the furniture would have been retrieved from the 'data bank' specially compiled for the project with regard to all regulatory, advisory and other relevant information. Again, this record of a statement of need or decision is available as a basis for evaluation at any future stage in the design-construction-operation cycle.

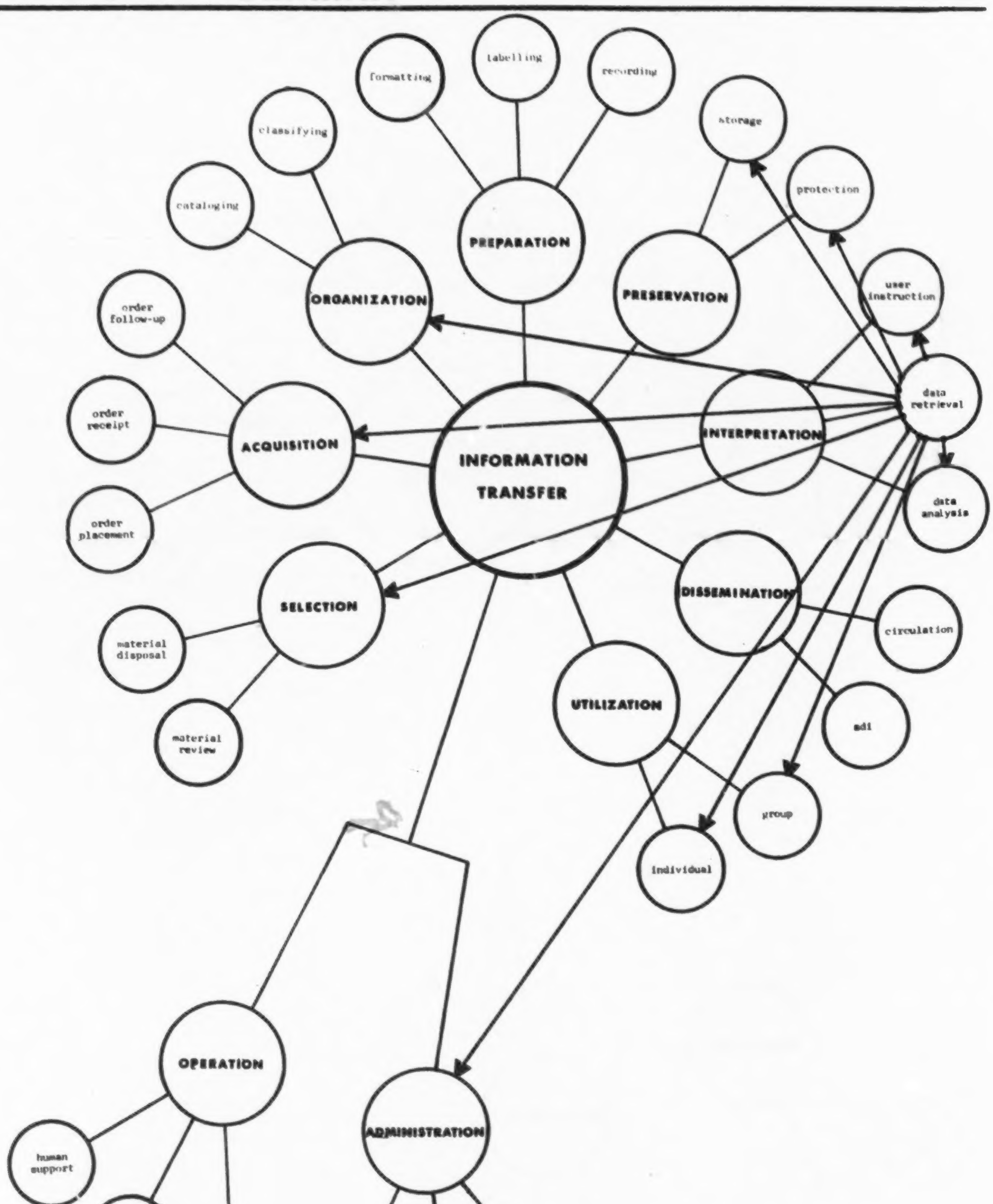
USER FLOW

TYPICAL MOVEMENT OF FIRST-TIME USERS


formatting
labelling
recording
classifying
storage
cataloging
PREPARATION
protection
ORGANIZATION
PRESERVATION
order follow-up
user instruction
data retrieval
order receipt
ACQUISITION
INFORMATION TRANSFER
INTERPRETATION
data analysis
order placement
SELECTION
DISSEMINATION
circulation
material disposal
UTILIZATION
sdi
material review
group
individual
OPERATION
ADMINISTRATION
human support
data support
facilities & equipment support
controlling
directing
planning

STAFF FLOW

REFERENCE LIBRARIAN


formatting
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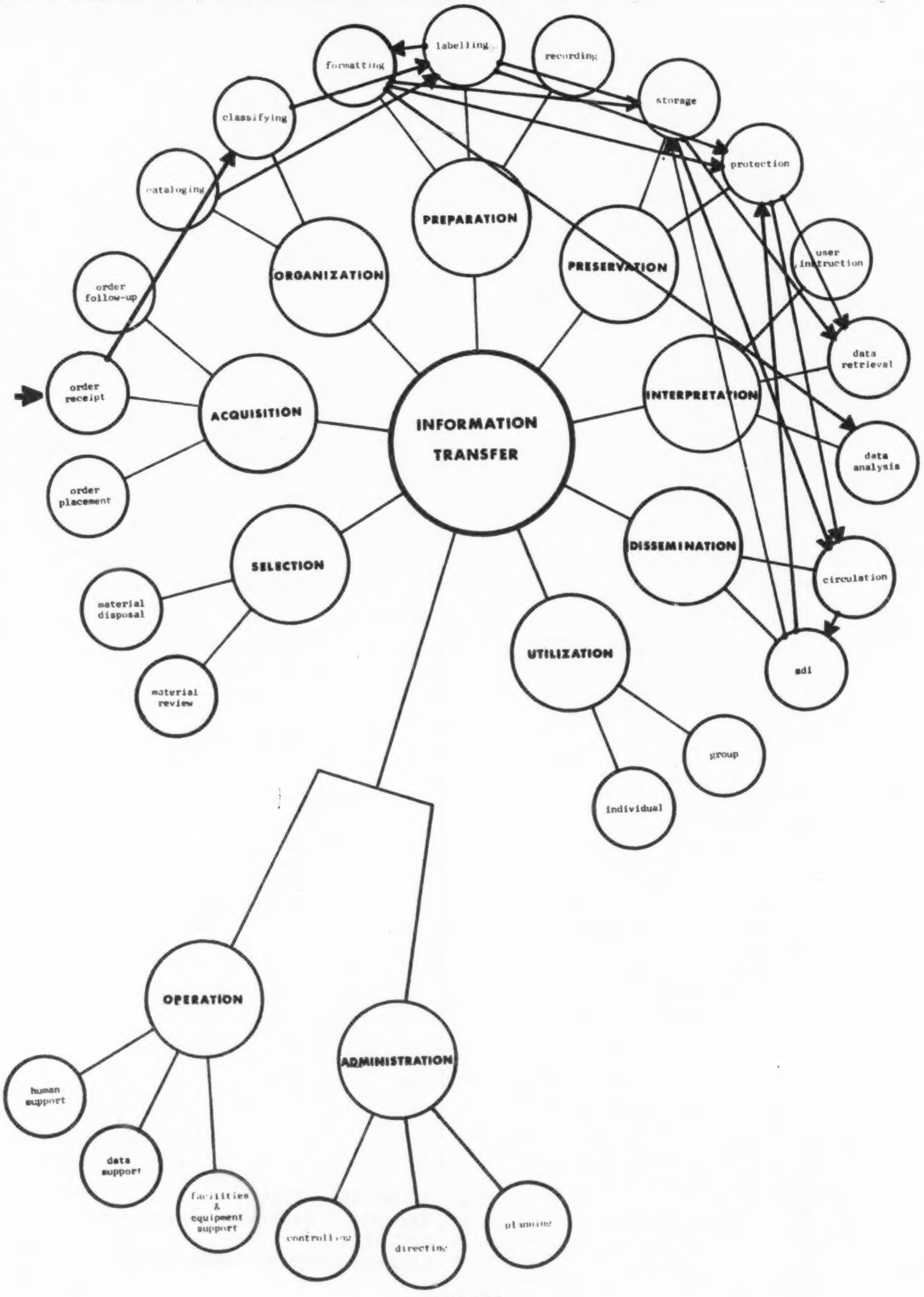
material review
group
individual
OPERATION
ADMINISTRATION
human support
data support
facilities & equipment support
controlling
directing
planning

MATERIAL FLOW

TYPICAL SEQUENCE OF EVENTS


labelling
formatting
recording
storage
classifying
protection
cataloging
PREPARATION
PRESERVATION
user instruction
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sdi
material review
group
individual
OPERATION
ADMINISTRATION
human support
data support
facilities & equipment support
controlling
directing
planning

PEOPLE

Patrons:
- 1. Adult
- 2. Children
- 3. Handicapped

Staff:
- 1. Professional
- 2. Clerical ✓
- 3. Janatorial

Use:
- 1.Times
- 2. Per Cent
- 3. Number of Hours 8
- 4. Time of Day 9-5

SERVICES

- 1. Disposal
- 2. Drainage
- 3. Sewerage
- 4. Pneumatic Tubes
- 5. Steam
- 6. Compressed Air
- 7. Vacuum
- 8. Security
- 9. Communications
  - a. Teletype
  - b. Telephone ✓
  - c. Intercom ✓
  - d. Television
  - e. Public Address
- 10. Electric
  - a. Power ✓
  - b. Light ✓
- 11. Clocks
- 12. Bells
  - a. Time
  - b. Warning
- 13. Ventilation ✓
- 14. Heating ✓
- 15. Air Conditioning ✓
- 16. Gas
- 17. Water
  - a. Cold
  - b. Hot

TRAFFIC

- 1. Foot ✓
- 2. Wheeled
- 3. Loading
- 4. Impacts
- 5. Abrasions

CONDITIONS

Air:
- 1. Smoke Free
- 2. Dust Free
- 3. Hygenic
- 4. Temperature ✓
- 5. Ventilation ✓
- 6. Humidity

Visual:
- 1. Art. Illumination ✓
- 2. Daylight ✓
- 3. View Out — if possible
- 4. Privacy ✓
- 5. Visibility
- 6. Blackout/Dimming
- 7. General Lighting ✓
- 8. Local Lighting ✓
- 9. Special Lighting

Security:
- 1. Human
- 2. Documents ✓
- 3. Fire
- 4. Burglary
- 5. Explosion
- 6. Poison

Nuisance:
- 1. Spillage
- 2. Dirt/Dust
- 3. Smell
- 4. Noise
- 5. Vibration

INTERVIEWEE Miss Smith

PROJECT UCLA: ILR. TISA
Technical Information Support
Activities
LIBRARY ENVIRONMENTAL DESIGN

DATE

BUILDING PERFORMANCE

BUILDING PERFORMANCE			PERFORMANCE GRADES 1	2	3	4
1. Dimensional.						
i.	Critical spans (feet).		8'	10'	12'	14'
ii.	Flexibility.		4"	1"-0"	2'-0'	
2. Environmental.						
i.	Sound insultation (STC):	Wall.	0-10	10-15	15-20	20-
		Floor.	0-10	10-15	15-20	20-
		Door.	0-10	10-15	15-20	20-
	Reverberation periods.		0.0	0.5	1.0	1.
ii.	Thermal performance (U):	Roof	.08	.10	.12	.14
		Walls	.08	.10	.12	.14
iii.	Temperature (^{o}F)		50	55	60	65
	Temperature Gradient-Fl-Ceiling.		1	2	3	4
	Temperature Diff. Outside int (F).		10	15	20	25
	BTU / s.f. of Floor.		20	25	30	35
iv.	Air:	Changes per hour.	1	2	3	4
		% outside air: total circul.	10	15	20	25
		CFM / s.f. of floor.	1.0	1.25	1.50	1.7
		Velocities @ breathing level.	20	25	30	35
v.	Cooling efficiency: BTU/watt total.		7.0	7.5	8.0	8.5
	Cooling area per ton (s. f.).		100	150	200	250
	Cooling permissible noise level NC.		20	25	30	35
vi.	Illumination:	Foot candles.	0-15	15-30	30-50	50-
		Lumens/s.f. floor.	7	15	20	30
		Watts/s.f. floor.	3	4	5	6
		Daylight factor.	0	1.4	3.0	4.0
vii.	Loadings:	Live lbs/s.f.	15	20	30	40
viii.	Fire resistance:	Types of Construction.	I	II	III	III
	Fire resistance:	Hours	0	1/2	1	2
ix.	Maintenance:	*Roof.	1	2	3	4
		Walls.	1	2	3	4
		Floors.	1	2	3	4
		Ceilings.	1	2	3	4
		Utilities.	1	2	3	4

*1. Care, repair and replace beyond normal.
2. Susceptibility to damage or control functions.
3. Susceptibility to damage or control functions under heavy use.
4. Good performance.

NOTES: Interviewer. Interviewee. Description.	Page 1 of ______	Project: UCLA: ILR Technical LIBRARY E FACILITIE

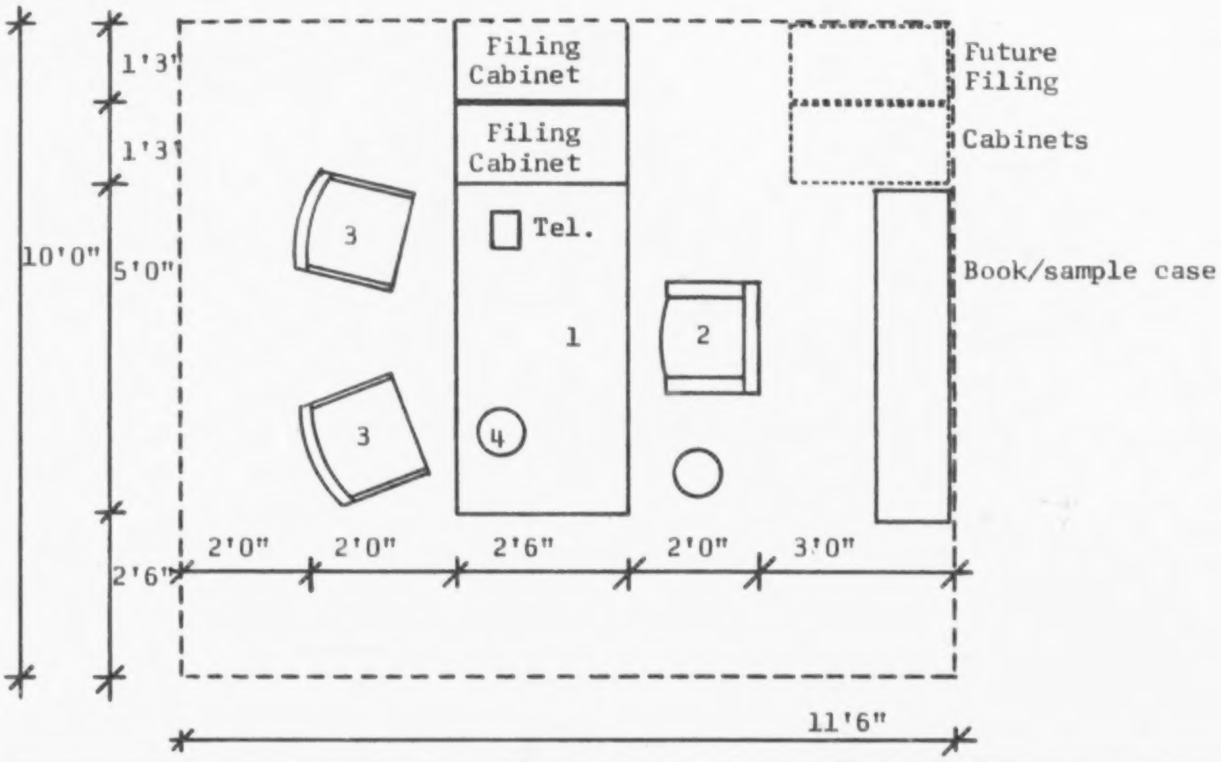
RFORMANCE GRADES

	2	3	4	5	6	7	8	9	
'	10'	12'	14'	16'	18'	20'			
"	1"-0"	2'-0'							
-10	10-15	15-20	20-30	30-35					
-10	10-15	15-20	20-30	30-35					
-10	10-15	15-20	20-30	30-35					
.0	0.5	1.0	1.5	2.0	2.5				
.08	.10	.12	.14	.16	.18				
.08	.10	.12	.14	.16	.18				
50	55	60	65	70	72.5	75	77.5	80	
1	2	3	4	5	6	7	8	9	
10	15	20	25	30	35	40	45	50	
20	25	30	35	40	45	50	55	60	
1	2	3	4	5	6	7	8	9	
10	15	20	25	30	35	40	45	50	
1.0	1.25	1.50	1.75	2.00	2.50	2.75	3.00		
20	25	30	35	40	45	50			
7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	
100	150	200	250	300	350	400	450	500	
20	25	30	35	40	45	50			
0-15	15-30	30-50	50-70	70-	100-	120-	150-	200-	
7	15	20	30	50					
3	4	5	6	7	8	9	10	11	
0	1.4	3.0	4.0	6.0	10.0				
15	20	30	40	50	60	80	100	100 +	
I	II	III	III	IV	IV	V			
0	1/2	1	2	3	4	4+			
1	2	3	4						
1	2	3	4						
1	2	3	4						
1	2	3	4						
1	2	3	4						

nal.
functions.
functions under heavy use.

	Page 1 of ______	Project: UCLA: ILR: TISA. Technical Information Support Activities. LIBRARY ENVIRONMENTAL DESIGN: PHYSICAL FACILITIES AND EQUIPMENT.	Date:

FUNCTIONAL LAYOUT:


Filing Cabinet
Filing Cabinet
Future Filing Cabinets
Tel.
1
2
3
3
4
Book/sample case
1'3"
1'3"
5'0"
10'0"
2'6"
2'0"
2'0"
2'6"
2'0"
3'0"
11'6"

Key

NOTES:

Library Furniture Item:	Interior Federal Specification
1. Desk; pedestal, charging.	AA-L-00300/6 (GSA-FSS) February 15,1967
2. Chair; straight, with arm, type 1 class 2.	AA-L-00300/4 (GSA-FSS) February 15,1971
3. Chair; straight, without arm, type 1, class 1.	AA-L-00300/4 (GSA-FSS) February 15,1971

Activities:

"Write letters to dealers".

"Interview salesmen and representatives".

"Maintain dealer/vendor file".

INTERVIEWEE Miss Smith

PROJECT
UCLA: ILR. TISA
Technical Information Support
Activities.
LIBRARY ENVIRONMENTAL DESIGN

DATE

Computerizing the System

The proposed generic planning system, outlined in the preceding pages, could be a computer based tool - the Guided Inquiry System suggested for development in Phase II. This system would lead the planning team step by step via an on-line console through the process of developing requirement statements and specifications (what he wants the building to do). It could combine the librarian's needs (as ascertained from replies to the structured program of questions) with factual information such as pertinent building codes, and effect some clustering of needs into an understandable, manageable program for the architect. Such a routine would aid the librarian in examining what is really wanted and then translate these expressed needs into a form to which the architect can be responsive. As the librarian and architect then begin to 'speak the same language', a more successful collaboration and, in turn, a more successful building will result.

Once plans have been generated by the architect, an improved process for pre-construction evaluation is necessary. A proposed process is VAL-SIM, a computer based method for evaluating simulated performance of building plans against previously generated specifications. The system would take the data generated by the Guided Inquiry System and systematically compare submitted plans against stated requirements. This data would then be translated into easily interpreted graphic output, such as bar graphs on an on-line computer console, for the convenience of the design team. The displayed data would then make clear conflicts and necessary trade-off situations in a much more rapid and systematic manner than manual methods such as visual inspection or hard calculation. On command, the system could also present the specific reasons why a certain evaluation was received. It would present detailed readings on the components of the element of worth being considered, showing exactly where the major problems or assets lay. Such a system could also be used to simultaneously compare and contrast several submitted alternative plans, presenting data for each on selected elements of worth, rapidly and in juxtaposition for dramatic visual comparison.

A proposed complement to VAL-SIM would be the application of the computer-based INTU-VAL system to the scale of a building. This system, in contrast to the purely evaluative function of VAL-SIM, would use data generated by VAL-SIM but also permit the users to actually modify the design on-line or to generate an entirely new solution. It permits modification and improvement of plans in an iterative fashion with feedback available from VAL-SIM following each change. Ideally, this function would be coupled with a computer-based aid such as CITYSCAPE (41) for the three dimensional visualization of the alternatives under consideration. Such images would also be subject to modification by users. Following such modifications, INTU-VAL could be consulted to determine the costs of such action.

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(41) Milne, Murray. From pencil point to computer graphics. In: Progressive Architecture, (June 1970) pp. 168-77.

The combination of VAL-SIM and INTU-VAL permitting the instant evaluation and modification of designs and ensuring re-evaluation in an iterative fashion is the key to improved evaluation and design. Once such tools have been made operational, it is possible to include the 'non-expert' as an active participant in the process of planning, design and decision making. His feedback is necessary to enrich and stimulate the field of architectural design.

IMPROVED IMPLEMENTATION PROCEDURES

The discussions in earlier parts of the report pointed out that considerable opportunities exist to institute improvements throughout the whole process of providing library facilities, particularly technical, academic and other specialist libraries in the Department of Defense and other government agencies. Some of these opportunities are indicated below as possible new procedures for providing Army libraries.

Technical Libraries for the Future Army

Major changes in the goals and structure of the military services can be anticipated in the future. Increasingly the user community will change as the Services come to rely on volunteers for recruits rather than on conscripts. New techniques in the design, construction, contracting and management aspects of facilities procurement are under constant development by both government and industry. Both aspects are likely to have a major impact upon the nature of the facilities and the manner in which they are provided. The prospect, however, can be contemplated with considerable satisfaction and can gain encouragement from the successes in developing concepts of organization and technology, both in the United States and elsewhere.

As stated earlier in this report, libraries of all kinds, and particularly post and camp libraries, are classified as one of the types of accommodation within the general category 'community facilities'. They have a very low priority in comparison with other facilities when priorities and budgets are being allocated. Whether or not this will continue to be true, if and when the Army does transform from an organization which depends on recruitment by conscription to one dependent on volunteers, remains to be seen.

However, the precedent of the British Army affords an interesting example which, if it is a relevant indicator, would suggest strongly that the provision of 'community facilities' is likely to assume a much higher priority in the future than in the past. In 1958, following recommendations made by a committee headed by Major General Lord Weekes, the Directorate of Works of the War Office was completely reorganized as an all-civilian office. Conscription to the Armed Forces had been superseded by recruitment through voluntary service, and the Army embarked upon the largest reconstruction program it had ever undertaken. A comprehensive analysis of its needs confirmed an early assumption that facilities for single soldiers would have to be improved very considerably if the Army was going to be able to compete for manpower with civilian industries. Barracks and community facilities were accorded the highest priority in the development of new concepts and solutions, including four-men-per-room barracks, the provision of private soldier (G.I.) messes, and increased provision of recreational and educational facilities, including libraries.

Indications of similar changes beginning to occur in the U.S. are represented by the recently instituted VOLAR (Volunteer Army) training concept, currently under way at Fort Ord, California, Fort Carson, Colorado and Fort Benning, Georgia. In this program, as in the U.K. precedent, barrack room occupancies are being reduced to between four and eight men, and community facilities are being made more attractive.

As the emphasis on continuing education extends throughout the Army (as in civilian life), the roles of libraries and information centers seem bound to undergo major changes in both concept and service provided. Current distinctions between technical, academic, specialist and recreational libraries may become less precise, and their roles more closely related. Although this concept can be only conjectural at this time, considerations of this kind are essential for the future if obsolesence in facilities is to be kept to a minimum. This concern is already recognized as evidenced by the following reference:

> "The criteria for permanent and semi-permanent construction does not envision separate buildings for each requirement. Fewer, larger and more flexible buildings are needed to efficiently house Army functions. The tendency to program facilities designed to a high degree of specialization detracts from the program and makes future alteration to meet new or changing missions expensive." (42).

It is incumbent upon those responsible for facilities in the future to consider every means for achieving more flexible buildings, by being more precise about statements of need for every user, and to question every stage of the process in a constant search for opportunities to achieve a 'better buy', or better value for the dollar invested.

If the goal to provide for ". . .fewer, larger and more flexible buildings" to meet new and changing requirements is to be satisfied, it is obvious that new procedures will have to be developed for determining needs, designing solutions, and constructing buildings, as well as adapting them to changing needs.

Extensive consideration has been and is being given to new procedures, both within the government and by private industry. Studies have been undertaken and projects implemented, to improve every stage in the process.

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(42) AR 415-15. p. 3-2, para. 3.1g. (2) (6). MCA program development, 1 July 1969.

These have included the development of new techniques for determining user needs and evaluating results; designing hardware systems to achieve flexibility in use and to accommodate changes in the future; and the implementation of more effective management procedures to improve the whole process. Some of these management procedures are discussed below.

Contract Management Control. A number of management control systems, some previously developed for non-building contracts within the Department of Defense, have been adapted for use in the building industry. These include various forms of scheduling networks such as Program Evaluation and Review Techniques (PERT), Critical Path Method (CPM), Critical Path Scheduling (CPS), Line of Balance Technology, Fast-Track, and others, all of which are widely known and applied in practice.

More recently the General Services Administration, Public Buildings Service (GSA/PBS), produced A Report on the System Used by PBS and Other Organizations (43), which considers alternatives in the "Construction Contracting Systems". This report includes three alternative procedures which are compared with current PBS Design/Bid procedures, with which GSA typically takes 64 months to design and build a $10 million dollar office building. By comparison, private industry can typically design and build an equivalent facility in 24 months.

The first alternative proposal is a modification only of current PBS practices, and would reduce the time to 43 months. The second proposal which introduces a 'construction manager', is estimated to reduce time to 26 months. The third would be a "Turnkey" operation and would therefore equate realistically with the time taken by private industry, i.e., 24 months. It is intended that these alternatives will be tried in practice in selected GSA programs. The response to the 'construction manager' proposal has already exceeded expectations. It is recommended, therefore, that all demonstration programs be monitored during Phase II of this study.

In all the PBS cases the times required for preliminary planning, site selection, and appointment of an architect are accepted as being variable, and no attempt was made to evaluate them or institute changes in current practice. However, it is obvious, from a study of the network of current Army procedures in the MCA cycle (see page 49) that there are additional opportunities to effect improvement in time for processing during these preliminary stages and to achieve additional savings in both time and money.

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(43) General Services Administration, Public Buildings Service. A report on the system used by PBS and other organizations. GSA, Washington, D.C., March 1970.

These aspects should also be considered in greater detail in the second phase of this study.

Program Building. In the case of the government in the United Kingdom program building attributes were exploited to form the basis for generating totally new ways of procuring Service buildings. In essence, it was recognized that the Army is a 'serial' or 'program' builder and not a 'project' builder, and as with fleets of automobiles, for example, buildings could be purchased en masse at advantageous terms and at an improved quality. Such a concept in the U.K. required considerable innovation and willingness to institute changes in procedures and contractural relationships as well as in technology. It requires that client organizations are much more precise in articulating needs, both quantitatively and qualitatively, as mistakes can have considerably wider implications.

Program building characteristics also exist in U.S. Army building programs but have not yet been adequately exploited. One of the characteristics is a combination of magnitude and continuity in the total building operation; another is the administration of the program resting with a single administering institution rather than with a multitude of separate authorities. Both these attributes are shared by other agencies of the Federal Government and have been exploited in the purchase of various items, e.g., equipment, weapon systems, uniforms, furniture.

The articulation of needs requires establishing closer working relationships with the representatives of building users. It requires the development of new forms of contractual relationships and conditions, new procedures by which to obtain bids, and new methods by which to monitor the execution of contracts. It involves new associations with industry. It affords new opportunities to achieve a level of stability in an otherwise unstable industry that is vulnerable to both seasonal and economic variations. The results have not been stereotyped buildings, nor the elimination of the need or opportunity for creative design. On the contrary, more time is made available in the process for the analysis of needs and their interpretation into a satisfactory and appropriate building, precisely because many of the repetitive aspects of the traditional process are more effectively organized and coördinated. Also, the design process can proceed with the assurance that costs are being identified, considered and controlled at every stage.

The characteristics of magnitude, continuity and central administration can and have been successfully exploited in practice. But to do so requires a willingness on the part of the authority concerned to undertake radical changes in organizational structure and procedures, such as those noted above.

New Hardware Solutions. Once the decision has been taken to develop new solutions, and new organizational arrangements and procedures have been established to implement them, new design and technological solutions will follow.

Some important precedents, derived from earlier European examples, have been created in the United States. Generally they have been concerned with a single type of building, e.g., schools, housing, etc., and have concentrated in a single area, e.g., California, Detroit, etc. However, they have shown that if problems are clearly stated and appropriate institutions created, exciting and relevant new solutions can result.

The opportunity afforded by the Army building programs, derived from their magnitude, diversity, and national applicability, is one which could be exploited to the advantage, not only of the Army and associated government agencies, but to the building industry as a whole. Library buildings constructed as part of programs for larger complexes, and within the philosophy of building more flexible facilities, would share in the benefits to be gained. It is recommended that a pilot program be instituted as a prototype project to develop new procedures, test appropriate technologies, and test the feasibility of mass purchasing of libraries, their furniture and equipment.

SECTION D

CONCLUSIONS AND RECOMMENDATIONS

RECOMMENDATIONS D

In this brief section we summarize our major conclusions, list our recommendations, and outline the major research areas for Phase II.

Conclusions

1. There is a generic base from which to plan and design all types of libraries.
2. There has been and will be very little basic change in the role and function of libraries, only changes in emphasis.
3. There has been little change in the process of planning and designing libraries during the last ten years.
4. There are no procedures developed specifically to meet the needs of Army technical libraries.
5. There are published definitions of functions, purposes and roles of Army technical libraries, but they are not adequate as a basis for developing a sound written building program.
6. There is a need to employ a multi-disciplinary team to plan a new physical facility, especially for Army technical libraries, where the design process is very complex due to existing planning constraints.
7. There is a need to have a detailed written building program, especially for Army technical library facilities, due to the long duration of the present building cycle, changing personnel, and potential changes in mission goals.
8. There is a need to develop techniques which allow for the evaluation of a great many design options, especially when designing a facility to use an existing space.
9. There is a need to develop a system that will allow the generation of design criteria from an analysis of activities rather than from arbitrary existing standards.
10. There is a need to develop procedures for coordinated decision-making throughout the entire building cycle, rather than isolated decision making.

11. There must be a better understanding of the implications of administrative, professional, capital, operating and maintenance costs on building life costs.

12. There is a need to simplify and shorten implementation procedures to achieve a faster design and construction time and reduce the overall cost of the project.

13. There are no operative, objective procedures available at present by which one may evaluate a library facility.

14. There should be a thorough review of all alternative facilities available which could provide the required amount of space, to ensure the likelihood of making the best decision about a new facility.

15. There is a need to make the evaluation process an integrated element throughout the entire planning and building cycle.

16. There is a great need to make post-construction evaluations of new facilities in terms of what the planners had expected and hoped to achieve in their original designs.

17. There are so many varied sources of information on specific space allocations and environmental performances, that it is very difficult for the planning team to evaluate the authority with which the recommendations are made.

18. There is a great range of apparently specific recommendations and quantification, but there is no assurance that the data are valid or useful.

19. There is little evidence that specific recommendations for space, light, seating, and other factors are based upon carefully controlled and unbiased testing programs.

20. There is, therefore, a need to examine all such data and, when necessary, set-up procedures to determine their validity.

Recommendations for Interim Use

All of the following recommendations are directed specifically to Army technical libraries; however, most of them can also be applied to the planning of any type of library.

1. The project librarian must be appointed at the inception of the project.

2. The project librarian must clarify the local library mission goals in the context of broader (military) institutional goals prior to preparing a written program.

3. The project librarian must identify the total user population and all major parameters, such as cost and time targets.

4. The project must be handled on a team basis with all members of the team involved throughout the entire project.

5. The planning team must include representatives of the user community to ensure a balanced planning base.

6. The team must explore all the alternative options for a new facility before moving ahead with the planning.

7. The team must make every effort possible to ensure adequate communication using mutually defined terms.

8. The team must prepare a detailed written program to provide a justification for the project and to clarify the understandings reached by the team members as to the requirements of the project.

9. The written program must be used as the means of communicating project requirements to individuals who are not team members.

10. The team should use a proximity chart for analyzing activity relationships until such time as the Guided Inquiry System has been developed in Phase II.

11. The team must review a large number of alternative design solutions in order to find the best possible solution, given the existing constraints.

12. The planning team should use a checklist of the elements of worth to institute an evaluation process.

13. The planning team should set the evaluation process using the generic evaluation methods described on pages 116-18.

14. The design data listed below are recommended only in the sense they are relevant to the design of Army technical libraries and some data must be used. All of the comments about the design data in Section B.V apply to these data. They can be used until such time as a set of tested specifications can be developed.

    a. allocate .1 sq. ft. per volume of the existing collection

    b. allocate 25 sq. ft. per reader station

    c. allocate space for 10-15% of the user community

    d. allocate 150 sq. ft. per library work station

    e. allocate .1 sq. ft. per 4 reels of microfilm

    f. allocate .1 sq. ft. per 9 maps

    g. allocate .1 sq. ft. per 6 phonograph records

    h. use the AASL recommendations for non-book materials (see page 138)

    i. ceiling height could be as low as 8'6"

    j. use the Wheeler-Githens formula (page 134) as a check for total space allocation

    k. try to keep the non-assignable space to less than 20%

Recommendations for Further Research

Research and development is urgently required on a number of interrelated subjects, although each could be undertaken as a separate study if this were the only practical alternative. A means of coordinating their related aspects must be found, however, if the work and results are to be fully effective. Among the topics identified in order of priority are the following:

1. Development of a comprehensive hierarchy of all potential library activities within the functional relationships defined in this study.
2. Development of appropriate ranges of environmental performance criteria and measures for Army technical library facilities.
3. Development of methods for generating alternative environmental design solutions.
4. A study of user behavior patterns in existing libraries to establish correlation between use and environmental factors, with regard to the various functions identified in this study, and for different types of libraries.
5. Development of effective evaluation procedures for use at various stages in the design, construction and operation cycle.
6. A comprehensive study of project management and control procedures, including costs, making recommendations for the selection and application of those with the greatest potential for effecting improvement in current procedures.
7. A study of possible alternative administrative procedures and organizational arrangement (both existing and as potential for the future) in respect to procurement methods so as to develop and test selected options under real world conditions.
8. An evaluation of the psychological impact of the total building environment on its users, including factors related to its location, access, etc.
9. Identification and definition of a prototype library construction project as a vehicle for implementing some or all of the above research and development program.
10. Development of criteria to establish relevant measures of the effectiveness of the library services being offered once the facility is in operation, in regard to types of users, individual functions, type of library, etc.

APPENDIX 1

WHAT IS A LIBRARY: PURPOSES, OBJECTIVES, DEFINITIONS

The purpose of a library is simple. It provides information. The organization and activities within a library, however, are not as simple as the primary aim. In fulfilling this purpose a library must select, acquire, organize, preserve, retrieve, interpret, and disseminate a vast array of materials in many forms.

What precisely, then, is a library? What are its objectives? What are its functions? Whom does a library serve? What does the library offer in materials and in services? The answers to these questions are fundamental considerations in planning the facilities in which libraries are housed.

Objectives

No library exists in a vacuum. It has concerns which are related to its parent organization whether it be a government agency, a university, a city, or a public school. The objectives of a library, in other words, are based upon the aims and the needs of its community of patrons. These objectives may be to help in the generation and utilization of information in the Army. They may be to aid in carrying out a research program of a university. They may be to provide information to the businessmen of a city. They may be to assist in offering an instructional program of a school.

In furthering its objectives, a library provides material in every conceivable type and format. Without these resources of information there is no library. On the other hand, without a staff to select, acquire, and interpret these resources, the materials may merely repose in an unused archive. Without the physical facilities in which to accomodate these services, furthermore, an ultimate meeting of reader and book may never occur.

In the triad of libraries--books, people, and facilities--the lack of adequate space may hold back a library's progress long after many other areas have undergone expansion. A properly designed facility of sufficient size is basic to effective service in any type of library.

Definitions

What is a Library? A library is a storehouse, a repository, an archive. It is also a center in which the interpretation and use of material become viable in fulfilling the information needs of a particular person. A library can be a static and reposing monument. A library can also be a vibrant and vital organism.

It is a service which a patron derives from the library, however, which really identifies it in the spectrum of information exchange. To offer a service which provides information through self-service or guided instructions is what a library is and can do best of all. "Where it's at," is wherever it is needed.

Information is often the product of or in direct support of research, development, tests, evaluation and related processes. A network of information services provides facilities and procedures by which information and data are processed and transmitted from originator to user. This network is composed of different types of services, of which a library is one example. A library's functions are concerned primarily with handling documents in contrast to an information analysis center which is concerned with the information contained in the documents.

A library rests upon the proposition that the dynamics of bringing books to people and bringing people to books is essential to a well structured and meaningful intellectual effort. In dealing so intimately with the process of transferring information from generator to consumer, continuity is a vital component in the real world assaulted by change. It is essential in such a setting that the principles of library service be imbued with intelligence and wisdom.

Who are the Users? Various information requirements of the countless libraries suggest user communities of comparable variation. Anyone who needs to know something, the likelihood of his answers being contained in assembled resources, is a legitimate library user. He may understand exactly how to retrieve the information from a complex store of data. He may be totally ignorant, on the other hand, of the classical approaches to information. He may be sophisticated in his use of bibliographical apparatus or he may be naive and uninformed. Identifying the user is critical, therefore, in establishing the nature of a library community.

How are They Served? One cannot offer public service to a library patron until one has materials available to provide such a service. The collections are the life blood of a library. To have on hand the right information at the right time for the right person is imperative for an effective library program.

The physical embodiment of information in this sense, however, is not confined to the book. Although the book, as we traditionally associate it with libraries, is still vital, it is by no means the full extent of materials contained in a typical collection. Microforms and other packages of information that touch all senses are often more appropriate and important in a particular collection. These media are sometimes replaced by rapid transmission of information through the use of individual response devices.

How Is It Managed? Few persons realize that there are more than one-hundred steps involved in merely acquiring a book, pamphlet, journal, technical report, map, microtext, or any other form of material which appears regularly on library shelves. This one task multiplied by scores of others of like importance consumes the time and effort of specialists in the technical services units of libraries. The personnel who interpret for the patrons all of the material acquired and organized for use, on the other hand, comprise the public service complement of a typical library.

Melding these two primary divisions into a cohesive service unit under one umbrella is the responsibility of a director, a chief, or some similarly called administrator. Depending upon the size of the establishment, there may be several staff members to provide the planning as well as the directional efforts in operating a library. Without a sound organizational structure in which all hands know to whom they are responsible and accountable as well as their precise duties, a library would falter and fail.

The Services

Purpose. What we are really talking about when referring to library services is the transferring of information. Moving it, that is, from the point of generation (the creator) to the point of consumption (the user). To assist in this process is an intermediary--the librarian. He helps to organize and store the material generated by an author. He must also help to retrieve, interpret, and disseminate the same information upon demand by a patron.

The Community

Before materials are selected, before staff is procured and before a facility is developed, consideration must be given in any library setting to the characteristics of the clientele to be served. In such an analysis, the types of users, the numbers of patrons, the growth and development of the community, and the patterns of use are important factors. Without this basic information, no ultimate building will accurately reflect the user.

Types. Several types of users will eventually present themselves in a typical library situation. The novice who knows nothing about the process of bibliographical investigation is of common concern. The bibliographical expert is the opposite consideration. Each has his special demands, however, which eventually must be translated into physical requirements.

Magnitude. Numbers of users are as important to determine in considering a library clientele as the types. The combination of classes and quantities of users often suggests special facilities. In a university setting, for example, one may recognize differences in needs of the undergraduate as opposed to the graduate students.

Dynamics. A library community ordinarily is not static. It is continually growing into many shapes and forms. The concern for this growth and change requires a flexibility in space requirements which cannot be overlooked in planning a facility.

Needs. Use patterns may vary substantially in any given setting. It may be according to the time of day, or week, or season, or year. There may be combinations of inquiries in which the demand is concentrated at one time if made by novices and another if by experts. Perhaps, indeed, the use is constant and offers no variation. Knowing the levels of demand, therefore, is vital in order to determine the number of stations, for example, tc provide for readers.

Resources

Types. As has already been stated, the resources in a typical library these days include more than books. Past emphasis has been on acquisitions and conservation of knowledge. Today's concentration, however, seems to be on making recorded knowledge available to users in accordance with their needs.

Information regarding the types of format acquired is necessary in calculating physical requirements. The consideration of books and their sizes as well as the pamphlets, journals, and technical reports, the films and microtexts and the plethora of other fugitive materials is essential.

Magnitude. Not only the types of material, but also the amount on hand is important in establishing space needs. The mix and related proportions of types are also necessary to know. It is one thing to provide space for 1,000 elephant folios and quite another to house 1,000 technical reports on microfiche. The exact proportions of all types as well as the numbers and their relationships are exceedingly important considerations.

Dynamics. To know only the types and quantities of the holdings is not sufficient. The projected growth of collections within the various classes of material is also necessary information in order to plan adequately for eventual accommodations. The determination of patterns such as greater or lesser emphasis on certain types of materials is primary to all other resource considerations.

Requirements. The first determinant made by a library user seeking information is whether or not something exists. This aspect of the search process is related directly to the concept of bibliographical access to information. In order to support this vital activity, an assortment of tools is usually available ranging from a catalog of the library's resources to vast numbers of indexing and abstracting sources as well as numerous reference works.

Is it information on a certain subject, or the works by a known author, or a specific title which is sought? These bibliographical tools are the key holdings of any collection. The intelligent use of these materials tells the reader what exists and in many cases where it can be found.

Having established the existence of information, the next step for a user is to locate it in order to have the material in hand. This phase of the utilization process is included in the concept of physical access to materials. The accommodations for these resources allowing for accessibility and the opportunities to borrow them readily are a fundamental concern in providing for facilities in any library. Will the material be on open shelves, for example? Will it be under lock and key? Will the transactions for loans be made on the self-service basis? What other system will be available to handle the recording of borrowers' transactions?

In describing this dichotomy of librarianship, Verner Clapp has written:

> "The ultimate objective of library work is to put into the hands of an inquirer a document or an item of information responding to his need. The techniques and apparatus by which the appropriate document or information is identified are those of bibliography. The apparatus includes systems of classification, catalogs, indexes and bibliographies of many kinds, including new varieties in the form of punched cards and computers. The techniques include the arts both of constructing and using the apparatus. . . .
>
> The bibliographic apparatus is merely a means to an end. Ultimately, the cited manuscript, book or

periodical must be seen and consulted, either in original form or in some acceptable facsimile." (44)

The Administration

Types. Managing an operation concerned with transferring information is usually accomplished within an hierarchical organizational structure. The chief administrator may have associates and supervisors under him as well as specialists to aid in planning, directing, and controlling the operation.

The ratio of professionals to non-professionals and other classes of employees is important to bear in mind, also, in as much as the basic space needs for each category frequently differ.

Magnitude. The sizes of library staffs fluctuate from place to place. Whatever the quantity, some number must be established at the outset of a planning exercise. Sufficient provision for future expansion of the staff complement is an overriding requirement, therefore, in library situations.

Dynamics. The development and organization of the collection together with the storage, retrieval, and interpretation of it constitutes the basic mission of a library staff.

In order that these persons can function efficiently in close proximity to each other, to the readers' areas, and to the bibliographical apparatus, adequate space precisely arranged is a necessary part of the total building requirement. In addition, these various services are frequently altered as the demands by patrons change. Flexibility, therefore, is again an important factor in this context.

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(44) Council on Library Resources. Eighth annual report, 1964. Washington, D. C., The Council, 1964, p. 11, 21.

APPENDIX 2

EVALUATION OF NON-LIBRARY BUILDINGS

Pre-construction evaluation of other buildings, like libraries, is in its barest infancy. Plans are compared using statistics such as the number of square feet per user, cost per square foot, or building efficiency. Such evaluation requires standards. A major problem in the determination of standards is that existing comparisons do not clearly separate specific activities. Some of these aggregated area and cost figures may or may not include special facilities such as auditoriums, cafeterias, or other facilities meeting unique requirements. Barring the separation of comparative statistics into generic functions, such work will remain of limited value.

Attempts to systematize the evaluation of alternative building plans were pioneered by Professor Alexander Klein, a German architect, during the 1930's. (45) Building on this foundation, Professor Peter Kamnitzer explored a method for the evaluation of alternative housing plans in 1951. (46) The principle of this exploration was the evaluation of alternative plans for one element of worth at a time (such as daylight, solarization, privacy, efficiency, furnishability, etc.).

Utilizing methods developed in England to quantitatively predict elements such as daylight from a plan's configuration and climatic conditions, the method was extended into other areas necessitating the invention of new indicators for such elements as privacy. Privacy was broken down into privacy from sound, privacy from view, and privacy from through traffic. Angles of view, areas under observation, and distance between viewer and sensitive living areas were measured and expressed in quantitative terms.

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(45) Kamnitzer, Peter. Alexander Klein and his work in evaluation of housing projects. Unpublished paper, Columbia University, December 1950.

(46) Kamnitzer, Peter. An attempt at an objective evaluation of dwelling unit plans. Thesis, Columbia University, July 1951.

The evaluation procedure started with a graphic presentation of the competing plans for elements such as sound zones (noisy, quiet and intermediate zones). A visual inspection of various configurations immediately provided an overall impression of the relative quality of the plan in terms of the elements graphically demonstrated. The second step was to list objective measures in terms such as the number of lumens in a given room for a given time, or the area or percentage of a room suffering from loss of privacy, or the number of decibels expected to be transmitted from noisy to quiet zones. The third stage required the establishment of standards (developed from case to case by a planning committee with access to technical assistance). Once standards have been agreed upon, measurement is possible in terms of these standards. (See examples of some completed tests pages 205-7).

In order to obtain one value for the entire unit rather than separate values for each room, weighting factors were introduced for each "element of worth". Weighting of all "elements of worth" remains a debatable issue (see discussion on page 116). At this point, it is sufficient to point out that comparisons between individual elements of worth have value in themselves and that totally weighted evaluation is subject to resolution of value conflicts.

The architectural firm of Caudill Rowlett Scott provides one example of how pre-construction building evaluation is employed. (47) Evaluation of a proposed plan is made by a jury composed of members representing the specialties of management, design, and technology. There are three basic categories of evaluation - form, function, and economy - each of which contains a number of questions to be answered about the design. On the basis of performance on these evaluative questions, the jury jointly assigns a numerical rating from 0 - 10 (where 10 is perfect) for each of the three main categories. These ratings are then graphically displayed as sides of a triangle and the resulting area of the triangle computed. This resulting single score or "quality quotient" is the overall evaluative rating and is compared to a scale which defines above 90 as a great building, between 50 and 100 as having a "strong aura of architecture". This method allows for post-construction evaluation also, with the possibility of comparing the jury's personal reaction to actual performance as ascertained by on site observation and interviews. Such a method is quite subjective.

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(47) Caudill, William W. Architecture by team: a new concept for the practice of architecture. Van Nostrand Reinhold, New York, 1971.

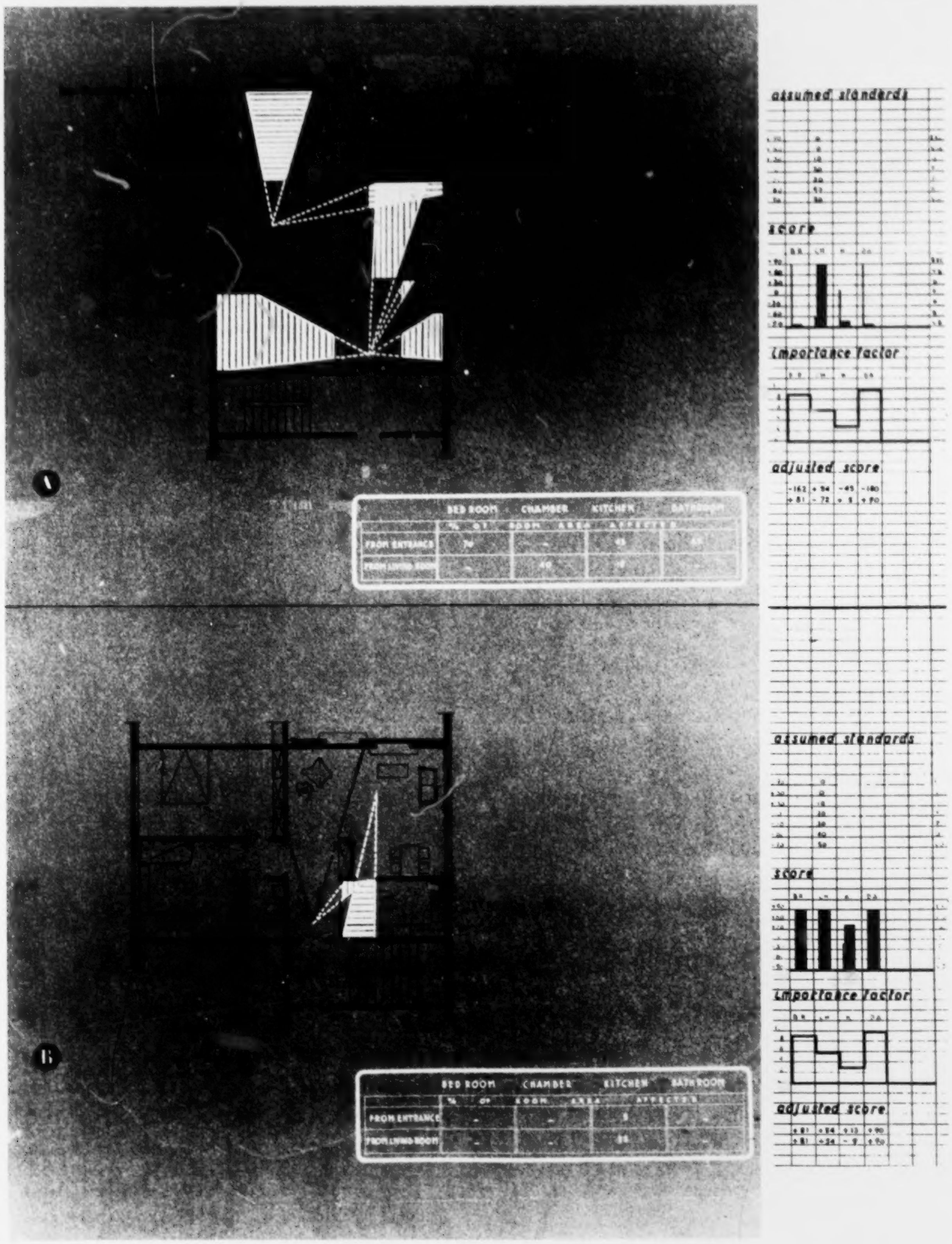
Post-construction evaluation in buildings, with very few exceptions, has been severely neglected. In architecture, in contrast to other fields, there is a dearth of systematic research. Systematic, objective evaluation of completed buildings is practically non-existent, resulting in a complete absence of feedback. Architects have yet to create the link between "expectation" and "performance".

Such evaluation is necessary in order to begin to know whether the expectations that shaped a particular design solution were actually borne out by the results. Certain elements such as lighting, acoustics, and air changes per hour (which are easily expressed quantitatively) may be specified during pre-construction, but they are rarely verified by post-construction tests. Other elements, such as interpersonal interaction which is not so easily expressed in quantitative terms, are never even specified in a clear manner, let alone tested after construction.

It appears that, until recently, we did not have any record of the expectations or performance required for such qualitatively expressed expectations as the hoped-for interaction between people, the mood to be achieved, the level of formality or informality desired, or the degree of indoor-outdoor usage expected. Planning committees are often divided by opposing sets of convictions. One group, for instance, may favor an open plan in order to achieve maximum interaction while another might prefer a more individual definition of spaces for a greater sense of privacy. Both groups may make excellent cases for their respective positions, with one point of view determining the final building arrangement. This emphasizes the need for a team planning process which includes user representatives. In Army technical libraries where user satisfaction is very important to the success of the operation this factor is extremely important. There is no reported evidence, however, that the actual performance of completed and occupied buildings has ever been compared with such critical pre-construction expectations.

EVALUATION OF DWELLING UNIT PLANS

PRIVACY OF VIEW : INSIDE


A
assumed standards
score
importance factor
adjusted score
-162 +94 -45 -180
+81 -72 +5 +90
B
assumed standards
score
importance factor
adjusted score
+81 +54 +13 +90
+81 +34 -9 +90

A

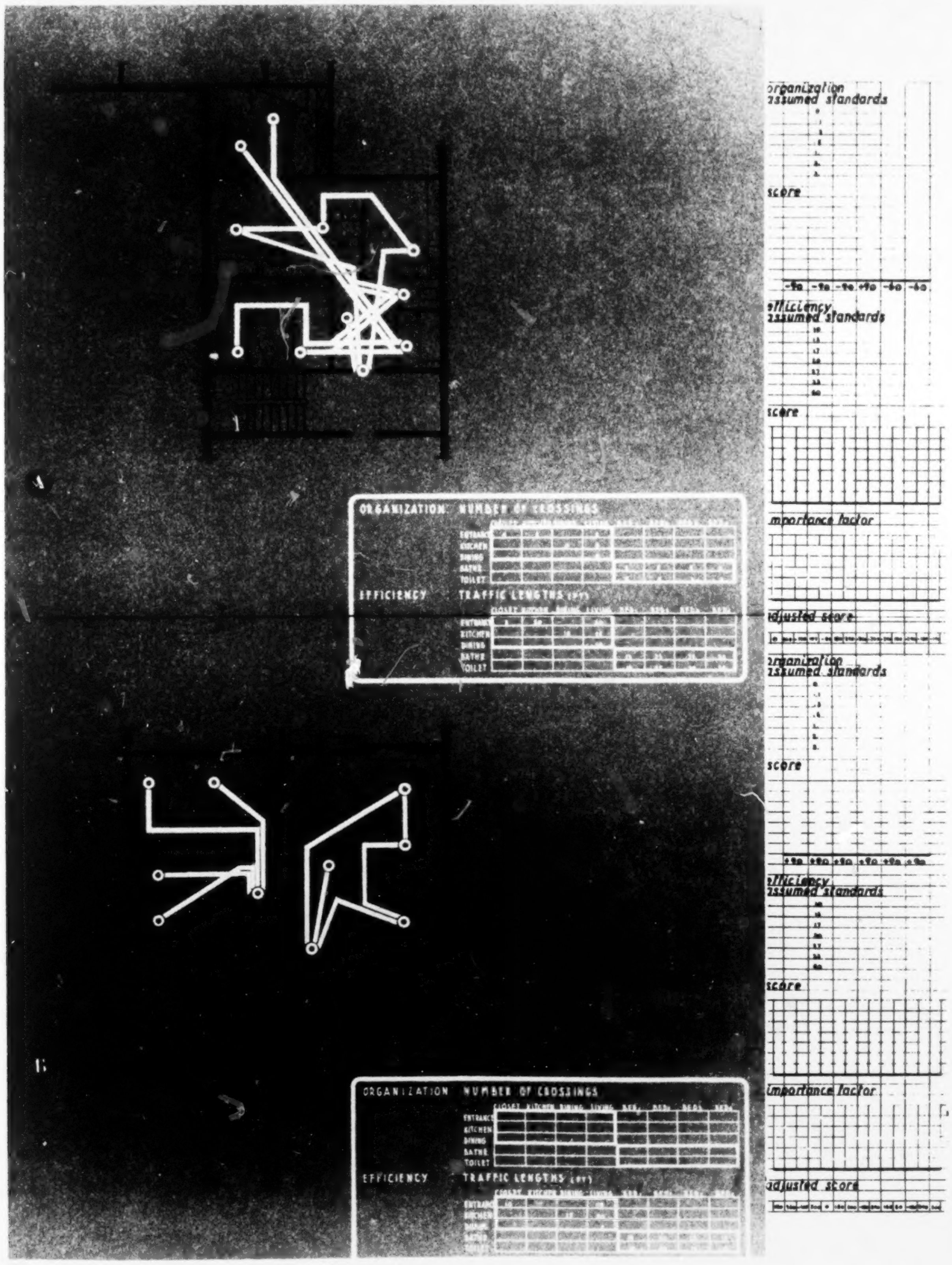
	BED ROOM	CHAMBER	KITCHEN	BATHROOM
	% OF ROOM AREA AFFECTED			
FROM ENTRANCE	70	–	45	45
FROM LIVING ROOM	–	40	10	–

B

	BED ROOM	CHAMBER	KITCHEN	BATHROOM
	% OF ROOM AREA AFFECTED			
FROM ENTRANCE	–	–	5	–
FROM LIVING ROOM	–	–	85	–

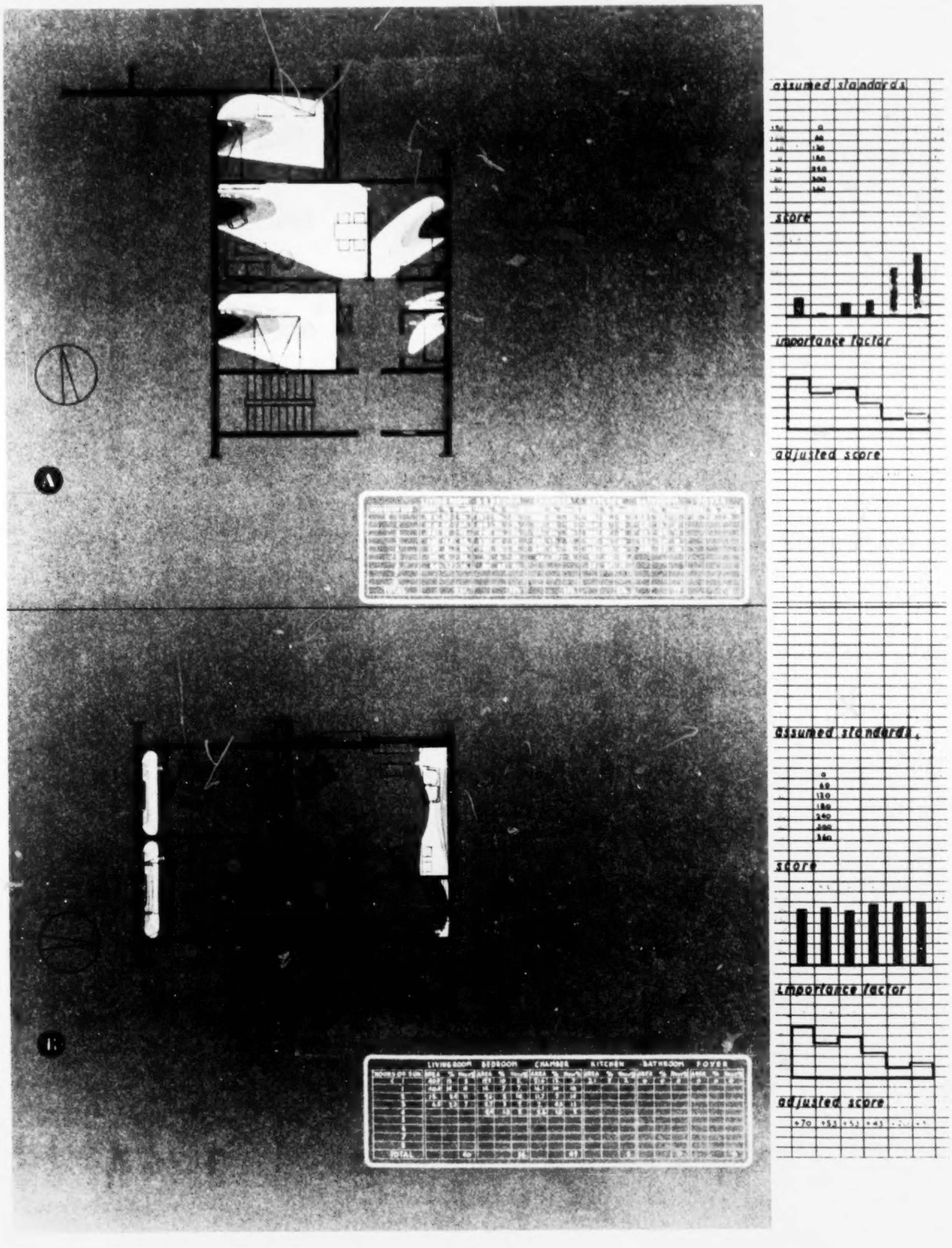
EVALUATION OF DWELLING UNIT PLANS

CIRCULATION


A
ORGANIZATION NUMBER OF CROSSINGS
ENTRANCE
KITCHEN
DINING
BATHS
TOILET
EFFICIENCY TRAFFIC LENGTHS
B
ORGANIZATION NUMBER OF CROSSINGS
CLOSET KITCHEN DINING LIVING
ENTRANCE
KITCHEN
DINING
BATHS
TOILET
EFFICIENCY TRAFFIC LENGTHS
organization assumed standards
score
efficiency assumed standards
score
importance factor
adjusted score
organization assumed standards
score
efficiency assumed standards
score
importance factor
adjusted score

EVALUATION OF DWELLING UNIT PLANS

SUN : JUNE 21


assumed standards
0
60
120
180
240
300
360
score
importance factor
adjusted score
A
B
LIVING ROOM
BEDROOM
CHAMBER
KITCHEN
BATHROOM
FOYER
HOURS OF SUN
TOTAL
+70
+53
+53
+43

Since 1967, however, potentially important work in the area of post-construction evaluation has been undertaken by the Building Performance Research Unit of the University of Strathclyde. The BPRU is engaged in the development of techniques for appraising buildings in use, and also in developing ways of appraisal during the design process itself, so that results of design decisions may be predicted more accurately and better choice of alternative solutions made. (48) The Building Performance Research Unit has set-up a conceptual model of the relationships in the building-user system (see diagram on page209). Summarizing the four main parts:

1) the building system, consisting of all the sub-systems, assemblies and components of which a building is constructed. There are three main sub-systems: constructional, services, contents

2) the environment, spatial and physical, generated by the building system and the activity of the occupants

3) the activity and behavior of the occupants, which is affected by and affects the environment

4) objectives of the organization to which the occupants belong and which has decided to put up the building

There is a second cylinder indicated at the bottom of the model, that of costs. Each of the four major parts has cost consequences:

1) the building costs something to design and construct

2) environment costs something to maintain (energy, cleaning, repair, maintenance)

3) activity costs something to provide (salaries, wages, non-productive time, sickness, absenteeism, turnover, recruiting, advertising, morale, materials for production)

4) objectives have values and priorities upon which some costs can usually be founded

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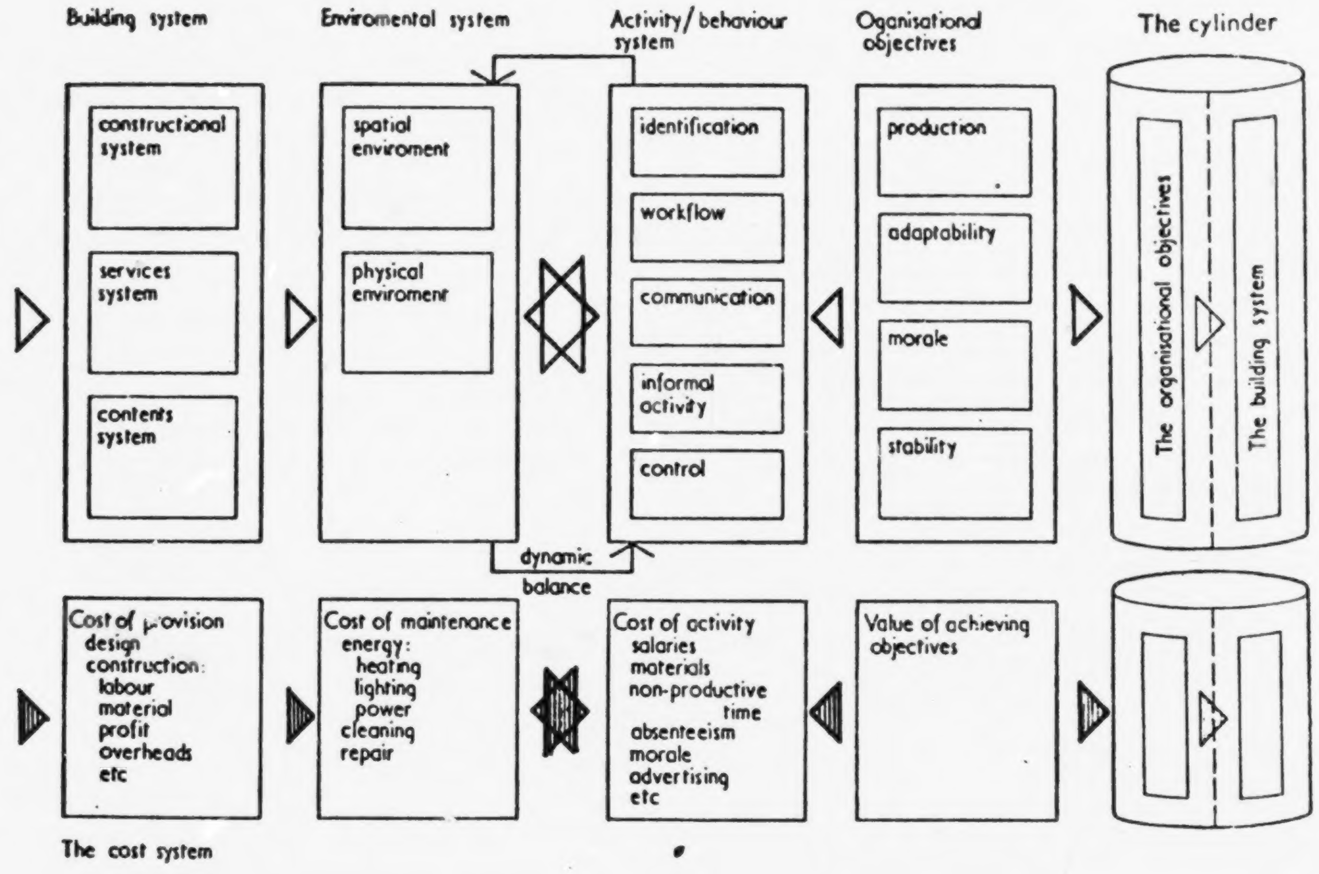
(48) Markus, Thomas M. The role of building performance measurement and appraisal in design method. In: Architects Journal, 146:25 (20 December 1967) pp. 1565-73.

BPRU CONCEPTUAL MODEL


Building system
Enviromental system
Activity/behaviour system
Oganisational objectives
The cylinder
constructional system
services system
contents system
spatial enviroment
physical enviroment
identification
workflow
communication
informal activity
control
production
adaptability
morale
stability
The organisational objectives
The building system
dynamic balance
Cost of provision
design
construction:
labour
material
profit
overheads
etc
Cost of maintenance
energy:
heating
lighting
power
cleaning
repair
Cost of activity
salaries
materials
non-productive time
absenteeism
morale
advertising
etc
Value of achieving objectives
The cost system

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Only by following this cylinder round, in relationship to the four parts above, can a rational decision on the "best" design be made, i.e., the design that achieves the best allocation of resources by maximizing cost-benefit considerations. As was noted on page in Section A, cost-benefit considerations are extremely important when confronted with converting a space from non-library to library use. Since Army technical libraries are most frequently placed in the position of utilizing such facilities this is of some significance for their planning process.

The BPRU has applied this model as the framework for the first full appraisal of a building in use -- the evaluation of the St. Michael Academy in Kilwinning. (49) The school evaluation is a detailed examination of the match between an ever changing need (education) and a provision (the building environment), and it puts forward the perhaps startling idea that matching of activities to the building spaces is a process which, far from being finished when the architect's work is done, continues as long as the building may last.

Some contributions of this study are:

1) Cost comparisons among various buildings by comparing percentages spent on such main elements as site preparation, substructure, structure, finishes and fittings and services (see figure on page 211).

2) Post-construction measurements for heat loss, daylight, and artificial lighting and comparison with pre-construction predictions (see figure on page 212).

3) Space utilization analysis by comparing existing space provision established by schedules with minimum spaces needed to fulfill requirements as determined by computer program.

4) A method for comparing percentage of total floor area devoted to circulation with other plans (see figure on page 212).

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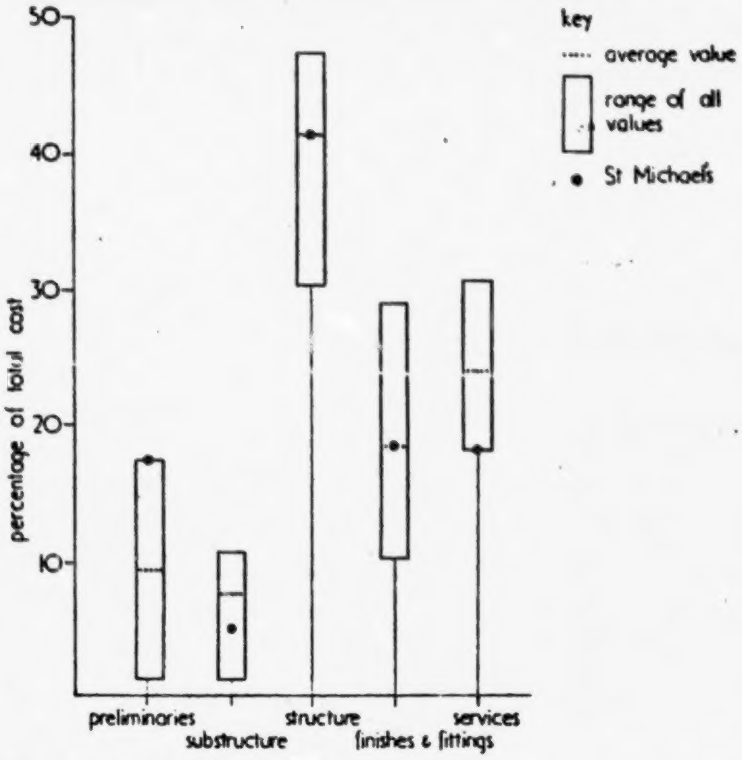
(49) Markus, Thomas A. Building appraisal: St. Michael's Academy, Kilwinning: a special study by the Building Performance Research Unit. In: Architects Journal, 151:1 (7 January 1970) pp. 10-50.

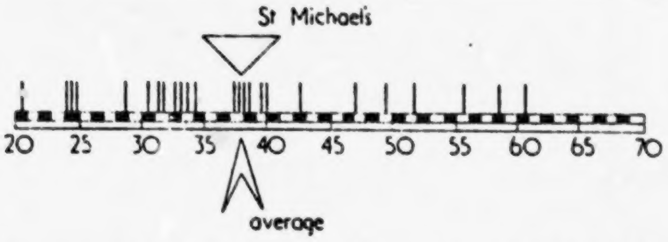
BUILDING APPRAISAL

RANGE OF INITIAL COSTS

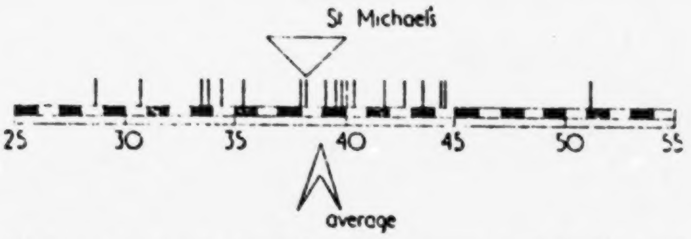


10 *Range of initial costs for fourteen schools*

VOLUME RATIO



13 POP *ratio of other schools compared with St Michael's (N = 26). High is good*



14 VOLM *ratio of other schools compared with St Michael's (N = 19). High is good*

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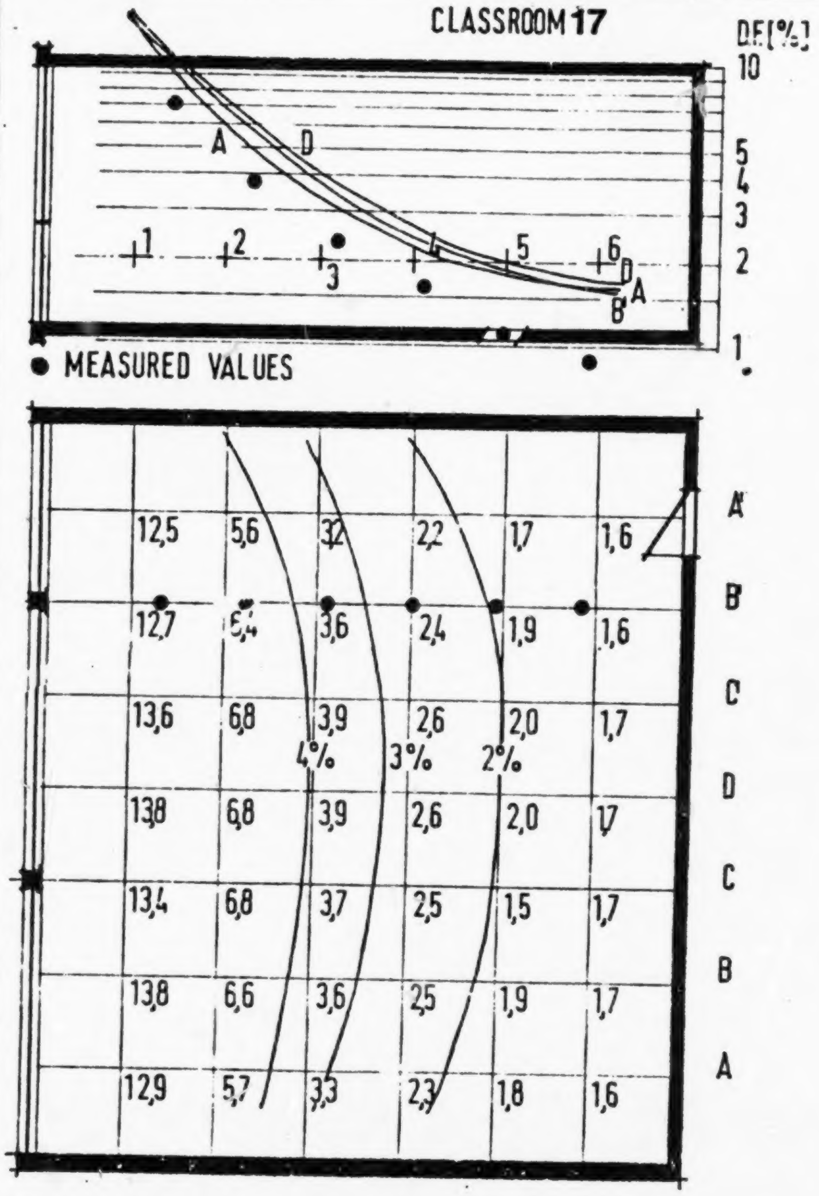
BUILDING APPRAISAL

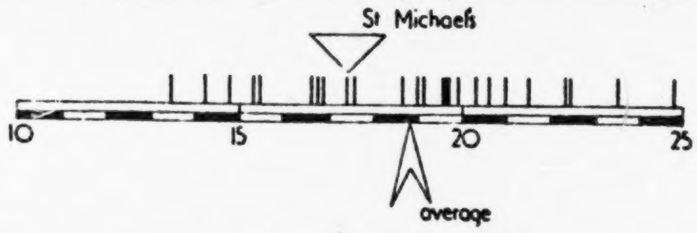
MEASUREMENT OF DAYLIGHT



12,5	5,6	3,2	2,2	1,7	1,6	A'
12,7	6,4	3,6	2,4	1,9	1,6	B'
13,6	6,8	3,9	2,6	2,0	1,7	C
13,8	6,8	3,9	2,6	2,0	1,7	D
13,4	6,8	3,7	2,5	1,5	1,7	C
13,8	6,6	3,6	2,5	1,9	1,7	B
12,9	5,7	3,3	2,3	1,8	1,6	A

17 *Daylighting in room 17. Section and plan. Calculated values shown by curves and by figures at intersections of grid*

PERCENTAGE OF CIRCULATION



31 *Percentage of total floor area devoted to circulation in other schools compared with St Michael's (N = 25)*

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5) A computer program which tests any schedule in terms of its flexibility in meeting any number of stated activity patterns.

6) Creation of a new measure for compactness of plan (see figure on page211), teacher satisfaction and teaching space cost.

7) Comparison of data from existing measures such as capital cost analysis and space allocation analysis with data on the same measures from other buildings of the same type, thus significantly increasing the value of such measures for evaluation.

Another focus for evaluation research is the subjective appraisal of buildings. The BPRU school evaluation includes such measures in the description of teacher satisfaction with their building. Canter and Wools (50) have done further work along these lines, and have developed a semantic differential scale to measure the psychological reactions of various individuals to both real rooms and rooms presented on slides. Their scales measure such perceived dimensions as "friendliness", "pleasantness", "comfort", etc. Further research in this area can make an important contribution to building evaluation by providing a systematic investigation of the important and much neglected area of the psychological impact of buildings on users.

There is a growing literature in the field of architectural psychology which deals with the interaction of human behavior and the built environment. One example of such research is a series of observational, questionnaire, and experimental studies undertaken by Robert Sommer (51) to learn how readers found privacy in public reading areas of a university library. Questionnaire studies showed that about half of a group of university students preferred the large public reading areas to the stacks. The replies indicated that some readers need to be with people, although direct eye contact is avoided. To achieve a modicum of privacy within a large area, individual readers marked out territories in various ways, using personal belongings and the positioning of their own chair. Most of the reported distraction came from human sources rather than physical aspects of the environment such as ventilation, lighting, etc. By studying behavior patterns of users in completed buildings, important insights can be gained which have direct implications for building design and subsequent evaluation.

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(50) Canter, David; Wools, Roger. A technique for the subjective appraisal of buildings. In: Building Science, 5:3-4 (December 1970) pp. 187-198.

(51) Sommer, Robert. The ecology of privacy. In: Proshansky, H. M.; Ittelson, W. H.; et al. Environmental psychology: man and his physical setting. Holt, Rinehart, Winston, New York, pp. 250-66. Also In: Library Quarterly, 36:3 (July 1966) pp. 234-38.

Evaluation of Non-buildings

The term "non-buildings" within the context of this report is used to refer to evaluation methods which do not specifically address themselves to the built environment. A considerable number of evaluative studies for library performance have been made in recent years. For example, of particular interest is a study by G. Edward Evans and Harold Borko entitled Effectiveness Criteria for Medical Libraries. (52) They define six basic criteria for evaluation of library performance: accessibility, cost, use, user satisfaction, response time and cost-benefit. These performance tests, however, do not specifically address themselves to the physical environment. It would be important to explore the potential applicability of these measures to the physical environment.

Investigating evaluation methods in other fields, it becomes evident that the urban planning field shares a dearth of proper methods with architecture. However, methods of evaluation in other fields might be useful for future adaptation to building evaluation: e.g., cost minimization techniques, cost effectiveness systems, optimization techniques, planning balance sheets and the goal-achievement matrix. Some of these take cognizance of competing sectors in society. On the scale of an individual building which competes for resources there are also different sectors of interest such as users, managers, and employees. Useful insight can be gained by testing a building, existing or planned, for each of these various interests.

Related Computer Work

Computers have been used in the context of building evaluation in a number of ways. The BPRU evaluation study used computers to calculate efficient use of space, to produce light curves, to study circulation patterns, to analyze wind loadings, etc.

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(52) Evans, G. Edward; Borko, Harold. Effectiveness criteria for medical libraries. Institute of Library Research, University of California at Los Angeles, April 1970, 64 p.

Within the context of research and development, computer graphics has been used as an aid to design and evaluation by:

1) Systems that can check designs against stated performance criteria and constraints;
2) Systems that will adjust the initial design through search routines;
3) Systems that evaluate intuitive designs; and
4) Systems that will produce designs within given constraints by optimization models and search routines.

URBAN 5 was an early example of computer aided urban design. (53) It utilized a basic module, a ten foot cube, and permitted architectural designers to assemble these in plan and section in any desired way. An "early warning system" pointed out when constraints or performance requirement specifications were not met and thus guided the designer to better solutions. Since these early beginnings a considerable number of computer programs have been developed as aids to planning and design. Another program is INTU-VAL, a computer graphics system which permits on-line design on a cathode ray tube and furnishes immediate evaluations in statistical and bar graph form. (54) It permits iterative design improvements, and facilitates non-expert participation within a participatory planning context. Page 216 illustrates a typical INTU-VAL output graph. The potential for use of computers and computer graphics in building evaluation was discussed in Section C dealing with future developments.

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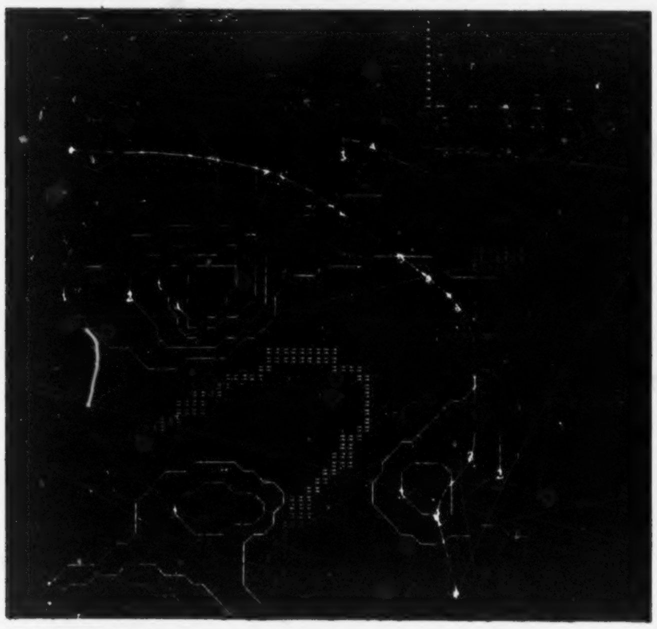
(53) Computer graphics in architecture and design. Milne, Murray, ed. Proceedings of the Yale Conference on Computer Graphics in Design, April 1968. Yale School of Art and Architecture, 1969, pp. 68-88.

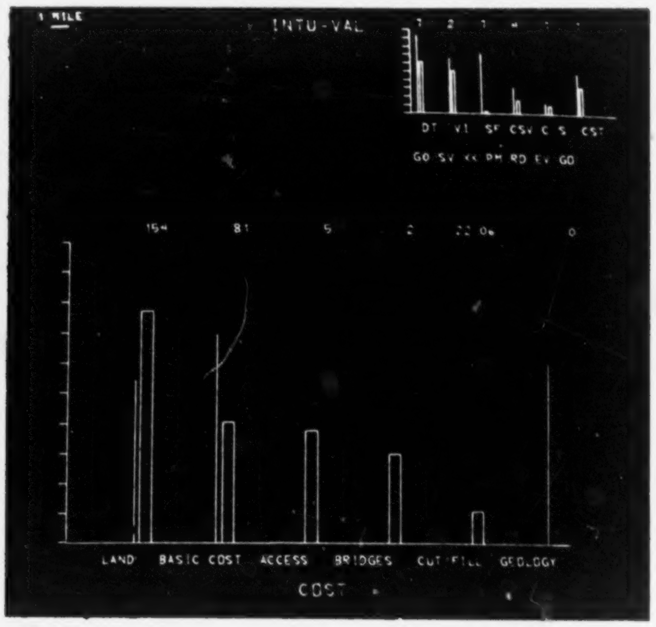
(54) Kamnitzer, Peter; Hoffman, Stan. An interactive computer graphic aid for design and decision making in urban planning. In: Archer, John; Eastman, Charles; ed. Proceedings of the 2nd Annual Environmental Design Research Association conference, Pittsburgh, 28-30 October 1970.

INTU·VAL

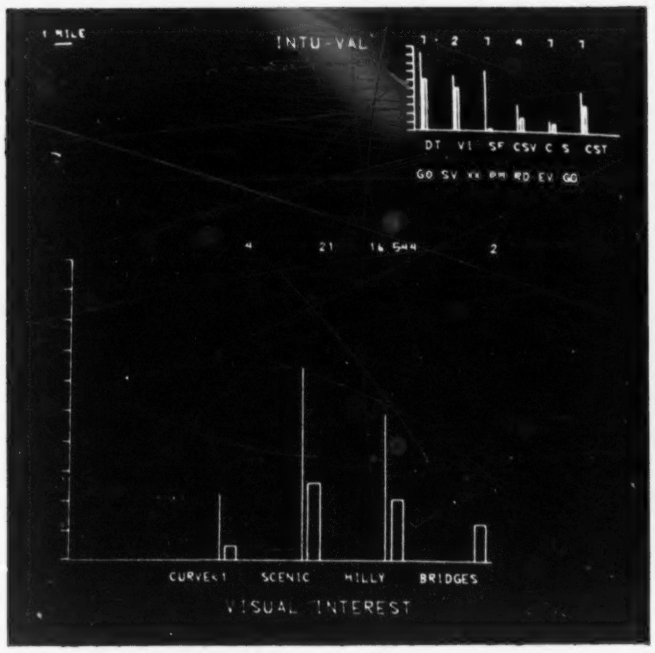
CRT SIMULATION



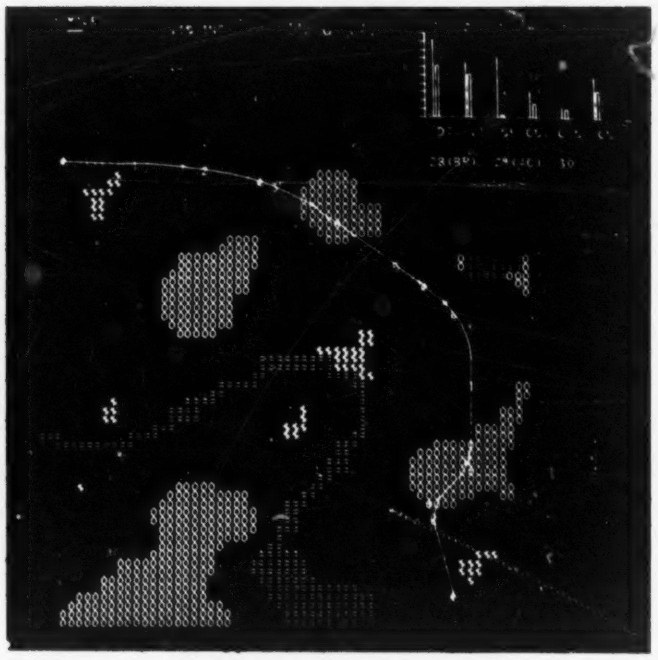
CONTOURS



COST



VISUAL INTEREST



VISUAL INTEREST

Using Other Building Evaluation Techniques for Library Facilities.

As noted earlier in the report (part B.IV), tools and methods for the evaluation of libraries are still largely undeveloped. There is a need for improvement in all stages of the evaluation process. The potential application of other systems to the evaluation of alternative library plans is shown in the following diagrams (pages 219-22). For purposes of demonstration, two imaginary library plans were drawn-up, one incorporating 'good' design features and one with a 'poor' plan. These plans were tested for a few 'elements of worth' (see explanatatory discussion on page 112). Note that these tests are merely considered as sketches of a possible direction for future research which would contribute to the development of a sophisticated tool for the systematic evaluation of libraries.

In the first illustration on page 219, the space allocations of the two hypothetical library plans are shown. The differences between the layouts are apparent: plan 1 has two entrance/exits where plan 2 has only one entrance; plan 1 concentrates the stacks along one end of the building and plan 2 distributes them in different areas.

The visual control test on page 220measures the per cent of reader areas and study space visible from the circulation desks of the two libraries. In plan 1, 32% of the total user space is blocked from view by moveable barriers and 45% is blocked by permanent barriers, resulting in a total of 77% non-visible user space. Plan 2 rates better in this particular test with a total of 59% of the user space blocked from the view of the circulation desk. Plan 2 also has a smaller percentage of permanent barriers.

In the second illustration on page 221, the visual control test is used to examine the supervision of critical service areas. Four points of service/access are identified below which may require the attention of a staff member to prevent distracting other users:

exit and entrance movement

equipment use (copy machines and card catalog)

heavy traffic (movement to and from the circulation desk)

restroom use.

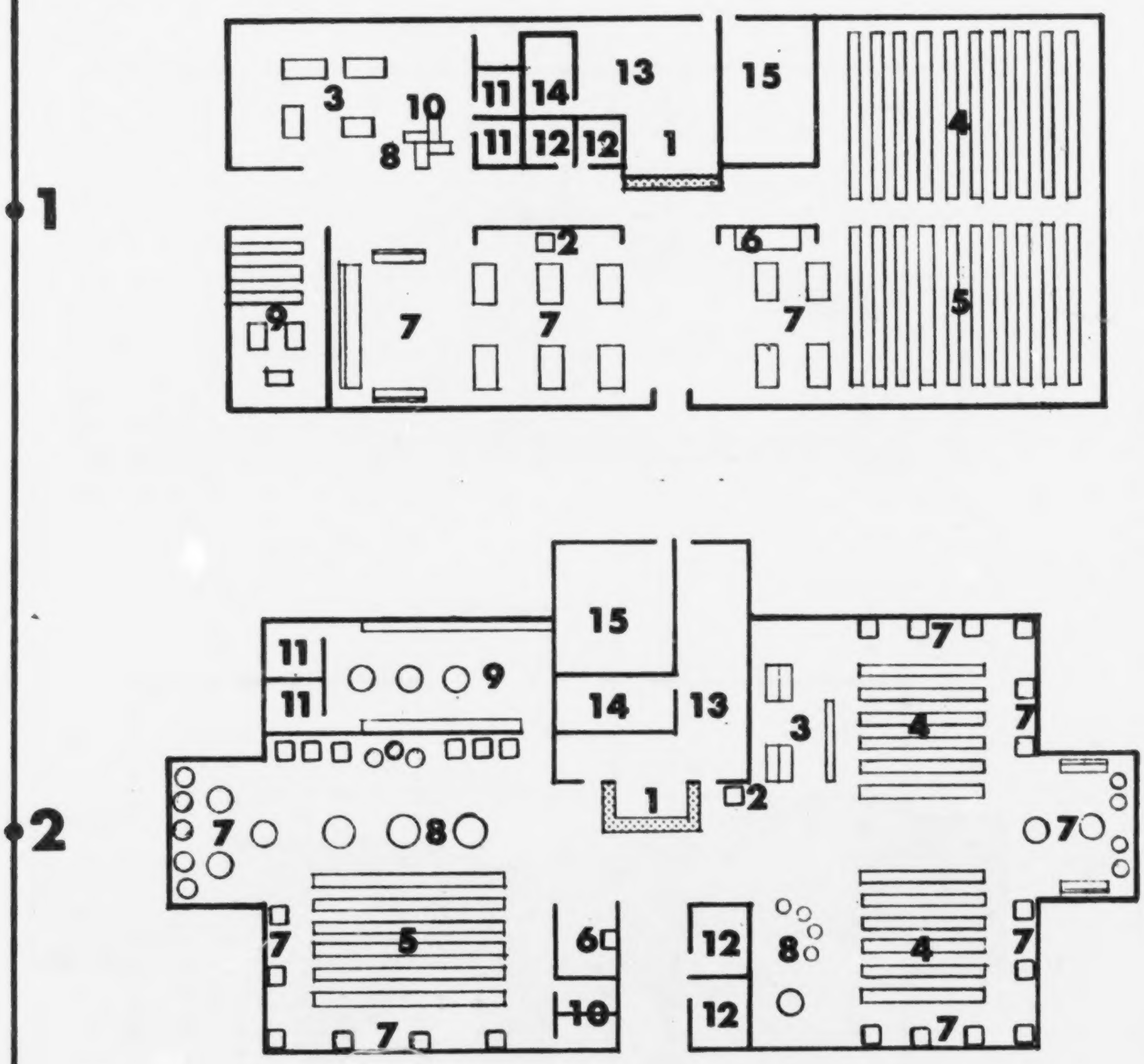
The two libraries are then compared on the basis of the number of service points which can be monitored from the circulation desk. In the first library only one of the two entrance/exits is visible, neither the copy machine nor the card catalog is seen and only one of the two restroom entrances is visible. The layout of the second library permits monitoring of the entrance, both the copy machine and the card catalog, but only one of the restroom entrances. Circulation desk traffic is monitored in both cases. Again library 2 receives a better score because of its layout.

The third test on page 222 is intended to rate the two libraries on noise control. Here three types of auditory zones in the libraries are identified: noise-generating, noise-tolerable and noise-sensitive. The legend at the bottom of the illustration hypothesizes that noise-generating zones are acceptable next to noise-tolerable zones and noise-tolerable zones are acceptable next to noise-sensitive zones. However, noise-generating areas are not acceptable next to noise-sensitive areas. The scores are computed by measuring the per cent of lineal feet of acceptable borders between different auditory zones.

These two hypothetical library plans were deliberately chosen to emphasize how a "good" and a "poor" layout affect various library activities. The tests shown are only a few of the many tests which would have to be invoked in order to evaluate library plans. Of course, value judgements would still have to be made when comparing alternative plans and the necessary trade-offs would be considerably more difficult in a real situation. Development of a series of tests such as those presented here would improve the decision making process.

EVALUATION OF HYPOTHETICAL PLANS

ALLOCATION OF SPACE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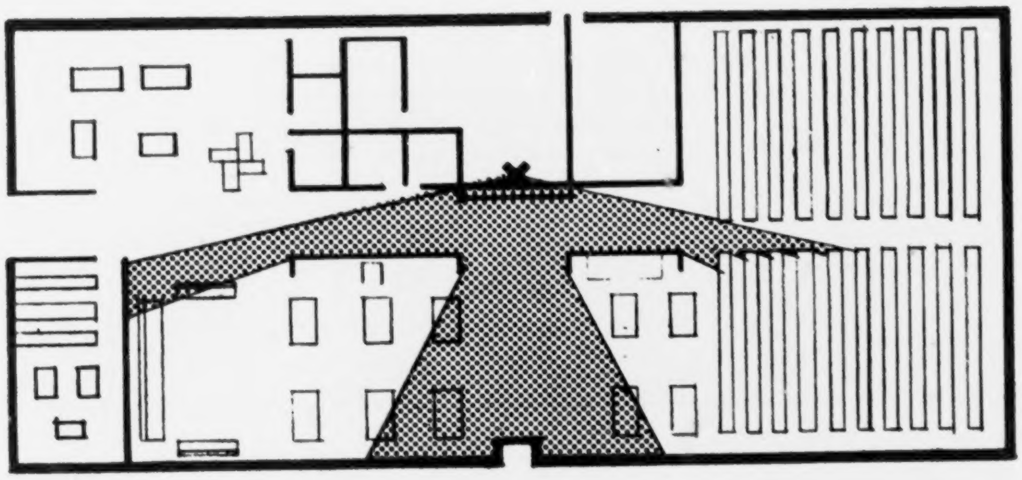
7

1 CHARGING DESK
2 CARD CATALOG
3 REFERENCE
4 NON-FICTION
5 FICTION
6 COPY MACHINE
7 READING
8 BROWSING
9 CHILDREN
10 TYPING
11 TOILET-CHILDREN
12 TOILET-ADULTS
13 STAFF
14 OFFICE
15 MECHANICAL

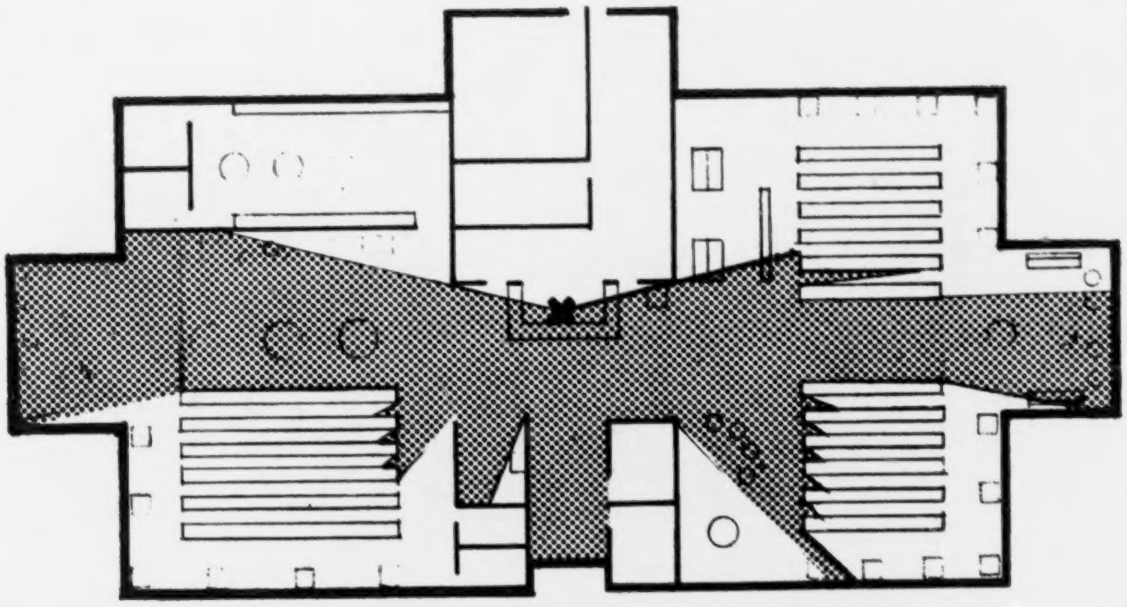
EVALUATION OF HYPOTHETICAL PLANS

VISUAL CONTROL

1



2



% OF USER SPACE VISIBLE FROM CONTROL DESK

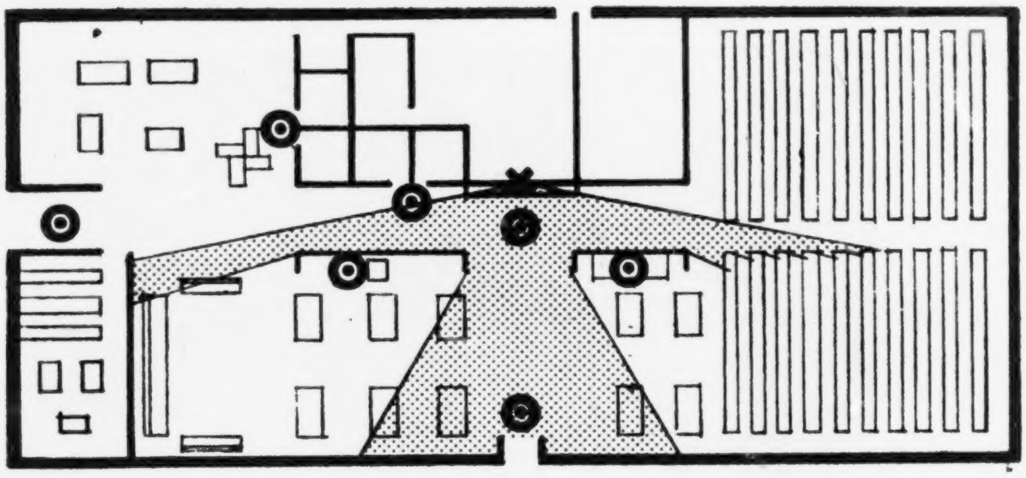
	MOVEABLE BARRIERS +	PERMANENT BARRIERS =	AREA BLOCKED	AREA VISIBLE
1	32%	45%	77%	23%
2	41%	18%	59%	41%

EVALUATION OF HYPOTHETICAL PLANS

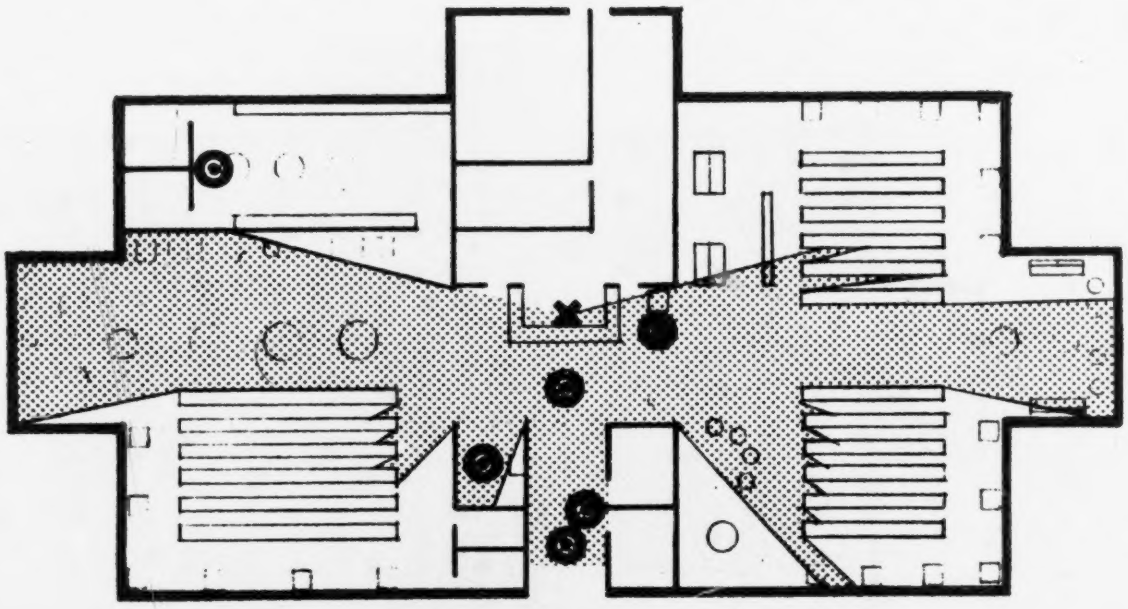
MONITORING SERVICE POINTS

⊙ POINT OF SERVICE / ACCESS

1



2



% OF DISTRACTION MONITORED

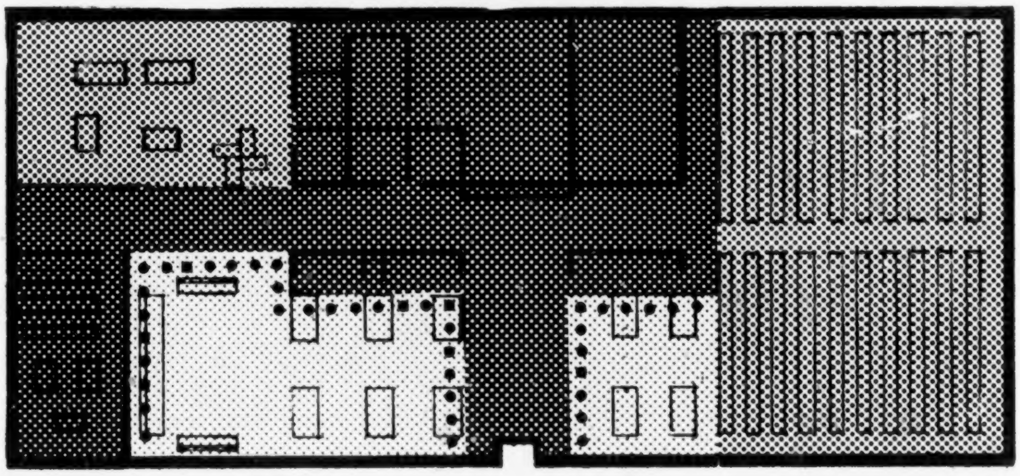
	EXIT/ ENTRY	USE OF EQUIPMENT	HEAVY TRAFFIC	TOILET ENTRANCE	TOTAL
1	1/2	0/2	1/1	1/2	3/7 = 42.8 %
2	1/1	2/2	1/1	1/2	5/6 = 83.3 %

EVALUATION OF HYPOTHETICAL PLANS

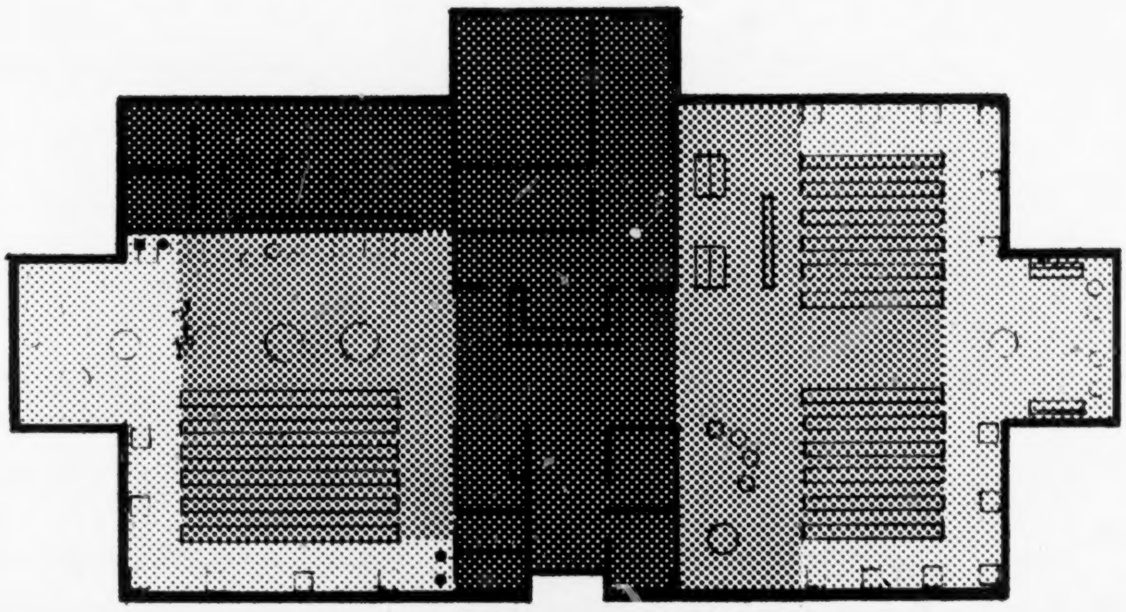
AUDITORY ZONING

NOISE: ▓ **GENERATING** ▒ **TOLERABLE** ░ **SENSITIVE**

1



2



% OF LINEAL FEET OF ACCEPTABLE BORDERS

1	**57%**
2	**96%**

▒░ **PROXIMITY ACCEPTABLE**

▓▒ **PROXIMITY ACCEPTABLE**

▓░ **PROXIMITY UNACCEPTABLE**

APPENDIX 3

LIST OF LIBRARIES VISITED

At the beginning of the project a number of libraries were identified by the TISA staff and the Advisory Panel as worth visiting, either because they were particularly well designed and functional, or because they illustrated something that would be valuable to the project. As a consequence, visits were made to over twenty libraries by one or another of the investigators and reports were written up of the visits from which information was drawn for the report. An attempt was made to distribute the site visits in such a way as to have visited as broad a range of different library types as possible.

Air Force Academy Library
Colorado Springs ,
Colorado

Air University Library
Maxwell Air Force Base
Alabama

Branch Library
Fort Ord, Calif.

Chamberlain Library
Fort Ord, Calif.

Colorado College Library
Colorado Springs, Colo.

Colorado State
University Library
Fort Collins, Colo.

Department of Housing
and Urban Development
Library
Washington, D. C.

Department of Transporation
Library
Washington, D. C.

Engineering Library
Project INTREX,M.I.T.
Cambridge, Mass.

Edison School Library
Santa Monica,Calif.

Hillis Library
Radcliffe College
Cambridge, Mass.

Hofstra University Library
Hempstead,Long Island, N. Y.

Hospital Library
Fort Campbell, Kentucky

Knox Library
Naval Post Graduate School
Monterey, Calif.

Lamont Library
Harvard University
Cambridge, Mass.

Mahan Library
Naval War College
Newport, Rhode Island

Military Academy Library
West Point, New York

Montgomery County
Library System
Montgomery County, Maryland

National Agricultural
Library
Beltsville, Maryland

Naval Academy Library
Annapolis, Maryland

Naval Research
Laboratory Library
Washington, D. C.

Office, Chief of
Engineers Library
Washington, D. C.

Office of Management
and Budget Library
Washington, D. C.

Picatinny Arsenal
Library
Dover, New Jersey

Plastics Technical
Evaluation Center
Dover, New Jersey

Santa Monica High School
Library
Santa Monica, Calif.

Scientific Information
Center
Redstone Arsenal
Huntsville, Alabama

Sink Library
Fort Campbell,
Kentucky

Stanford University
Libraries
Stanford, Calif.

University of California
Library
San Diego, Calif.

University of Connecticut
Library
Storrs, Connecticut

University of Indiana
Libraries
Bloomington, Indiana

University of North Carolina
Undergraduate Library
Chapel Hill, N. C.

University of Pennsylvania
Library
Philadelphia, Pa.

Wellesley College Library
Wellesley, Mass.

Wessell Library
Tufts University
Medford, Mass.

APPENDIX 4

LIST OF PERSONS INTERVIEWED

Kenneth Allen, Associate Director
University of Washington Library
Seattle, Wash.

Alfred Anzaloni, Staff
Plastics Technical Evaluation Center, Picatinny Arsenal
Dover, N.J.

Doris Baster, Acting Director
Naval Research Laboratories Library
Washington, D.C.

Cecil Byrd, University Librarian
University of Indiana Library
Bloomington, Ind.

Frances L. Carey, Director
Educational Resources, Mahan Library, Naval War College
Newport, R.I.

Cleo Cason, Chief Librarian
Scientific and Technical Information Center, Redstone Arsenal
Huntsville, Alabama

Michael Costello, Chief
Scientific and Technical Information Branch, Picatinny Arsenal
Dover, N.J.

Commander Crowley, Civil Engineering
U. S. Naval War College
Newport, R. I.

Richard De Gennaro, Director
University of Pennsylvania Library
Philadelphia, Pa.

William Donald, Architect
Wittenberg, Delony and Davidson
Little Rock, Arkansas

Richard Evans, Director
U. S. Naval Academy Library
Annapolis, Maryland

Ruth Fine, Director
Office of Management and Budget Library
Washington, D. C.

Norman Finkler, Director
Montgomery County Libraries
Maryland

Norman Fletcher
Architects Collaborative
Cambridge, Mass.

Elsa Freeman, Director
Department of Housing and Urban Development Library
Washington, D. C.

Harold Gores, President
Educational Facilities Laboratories
New York, N. Y.

Robert Gutman, Professor
Department of Sociology, Rutgers, the State University
New Brunswick, N. J.

Michael Harris, Architect
Harrison and Abramowitz
New York

Leonard Hunter, Senior Vice President
John Carl Warnecke and Associates
San Francisco, California

Major Claude Johns, Jr., Director
U. S. Air Force Academy Library
Colorado Springs, Col.

Mrs. Kimsey, Chief Librarian
Sink Library
Fort Campbell, Kentucky

Mary Jane Lang, Office of Colin St. John Wilson, Architect
London, England

George Luckett, Director
U.S. Naval Postgraduate School Library
Monterey, Calif.

John McDonald, Director
University of Connecticut Library
Storrs, Conn.

Bernard Martin, Chief
Furniture and Furnishings, Standardization Branch, General Services Administration
Washington, D. C.

Ellsworth Mason, Director
Hofstra University Library
Hempstead, Long Island, N. Y.

Keyes Metcalf, Consultant
Cambridge, Mass.

Philip Morse, Faculty
Operations Research Center, Massachusetts Institute of Technology
Cambridge, Mass.

Kirby Payne, Director
Department of Transportation Library
Washington, D. C.

Harry Pebly, Director
Plastics Technical Evaluation Center, Picatinny Arsenal
Dover, N. J.

Glenna Piersall, Director
Fort Campbell Libraries
Fort Campbell, Kentucky

Frazer Poole, Coordinator of Building Planning
Library of Congress
Washington, D. C.

Major Pound, Special Services
Fort Ord, Calif.

Melita Rodeck, Architect
Design Section, Military Construction, Office of the Chief of Engineers
Washington, D. C.

Robert Rohlf, Director
Hennepin County Libraries
Minneapolis, Minn.

Charles Schliecker, Assistant Librarian
University of North Carolina
Chapel Hill, N. C.

Ada Schwartz, Director
Army Library Program
Washington, D. C.

Robert Severance, Director
Air University Library
Maxwell Air Force Base, Alabama

John Sherrod, Director
National Agricultural Library
Beltsville, Md.

Miss Smith, Librarian
Chamberlain Library
Fort Ord, Calif.

Charles Stevens, Staff
Project Intrex, Massachusetts Institute of Technology
Cambridge, Mass.

Hugh Stubbins, Architect
Hugh Stubbins and Associates
Cambridge, Mass.

David Weber, Director
Stanford University Libraries
Stanford, Calif.

Ruth Weinstock, Research Associate
Educational Facilities Laboratories
New York, N. Y.

Egon Weiss, Director
U. S. Military Academy Library
West Point, N. Y.

Colin St. John Wilson, Architect
London, England

Karel Yasko, Special Assistant to the Commissioner
General Services Administration
Washington, D. C.

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GENERAL WORKS

- Bibliographies

ARMY LIBRARIES

- General Information and Case Studies
- Regulations and Specifications-Department of the Army Publications

OTHER LIBRARIES

- Academic
- Federal
- Public
- School
- Special/Technical

SPECIFIC TOPICS

- Planning/Programming
  - building program
  - construction
  - design methods
  - evaluation
  - location
  - moving
  - planning team
  - psychological needs
- Functional Requirements
  - automation
  - material preservation
  - material storage
  - space allocation
  - staff areas
  - user areas
- Physical Requirements
  - access for the handicapped
  - environmental control
  - fire protection
  - floor coverings
  - lighting

- Financial Requirements
  - costs
  - funding
  - maintenance
- Equipment
  - audio-visual
  - mechanical
- Furniture

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